A. I. A. File No. 30f2

1021-21

2625

An ELECTRIC *System of* TEMPERATURE CONTROL



DISTRIBUTED BY
Culbert-Whitby Company
2019 Rittenhouse St.
PHILADELPHIA, PA.

BULLETIN B2

BARBER-COLMAN COMPANY
ROCKFORD, ILLINOIS

A. I. A. File No. 30f2

F 1023-2
PRINTED
IN U. S. A.
J U L Y
1 9 3 1

The

BARBER-COLMAN
Electric System
of
TEMPERATURE CONTROL

BULLETIN B2

Manufactured and Distributed by

BARBER-COLMAN COMPANY

General Offices and Plant

ROCKFORD :: ILLINOIS

U. S. A.



BARBER-COLMAN COMPANY

Designers and Manufacturers

Rockford, Illinois

TEXTILE MACHINERY DIVISION

Established 1900

Automatic Spoolers
High Speed Warpers
Warp Tying Machines
Warp Drawing Machines
Hand Knotters

MACHINE AND SMALL TOOL DIVISION

Established 1908

Hobs
Milling Cutters
Hobbing Machines
Reamer Sharpening Machines
Hob Sharpening Machines
Reamers

ELECTRICAL APPARATUS DIVISION

Established 1926

Door Operators
(Radio-Controlled and Switch-Controlled)
An Electric System of Temperature Control
The Barcol OVERdoor

INTRODUCTION

AUTOMATIC temperature control is desirable in every type of building, because it not only promotes comfort and human efficiency but also makes for more economy in heating. Automatically controlled temperature has been in use for many years in office buildings, theatres, schools, large public buildings, some factories and a few homes. With the advent of new heating, cooling, and humidifying systems, automatic temperature control is becoming more important and more widespread in its application every day. Without doubt the future will see its almost universal use.

This publication describes a new development in temperature control equipment which possesses many advantages that make it desirable for use in conjunction with present and future heating, ventilating, and air conditioning equipment. The principal feature of Barber-Colman control equipment is that electricity, which is daily becoming a more universal and widespread carrier of power, is applied successfully to this work. Much ingenuity and special research has gone into the development of the various elements of this system so that each may perform its function accurately, quietly and dependably to the complete satisfaction of the owner. All of the equipment has been thoroughly tried out in commercial installations over a period of several years so that it has a foundation of demonstrable performance.

This equipment has been developed by the engineering laboratories of Barber-Colman Company and is manufactured completely in the Barber-Colman Plant where skilled workmen having years of precision experience insure the proper fabrication of the parts. The sales and service staff consists of capable men who have received a thorough training at the plant in order to insure that they may give the customers the best possible service.

Sufficient variety of equipment has been developed so that control apparatus may be installed on almost any of the various types of heating, ventilating, and air conditioning systems. The Company is always seeking new applications for the equipment and invites inquiries concerning its use on any type of system whether mentioned in this publication or not. All Barber-Colman temperature control equipment is guaranteed for satisfactory operation. Competent engineering counsel and a free yearly inspection service is available to all customers.



How
ELECTRICITY
is used for
TEMPERATURE CONTROL

IN any temperature control system the principal piece of equipment is a temperature-sensitive instrument called the thermostat. This thermostat governs the opening or closing of valves, the starting and stopping of fans and the positioning of dampers, depending upon the type of heating system in conjunction with which it is installed.

The Barber-Colman *Electric* System of Temperature Control uses *electric*-motor-operated valves and damper controllers governed by *electrically* connected thermostats. The thermostat contains as its temperature-sensitive element a bimetallic loop with an extension tongue which is free to move between two fixed contact points. When the thermostat calls for heat, the bimetallic loop causes the tongue to make contact with one point, thus closing a circuit to the motor-operated valve or damper controller. The motor in the damper controller or valve, by means of reduction gears, turns a shaft which operates the valve plunger or moves the damper, thus "turning on the heat."

When the thermostat calls for "less heat," the expansion of the bimetallic loop moves the tongue against the other contact, thus starting the motor again and closing the valve or moving the damper to deliver less heat. Thus the thermostat is a constant automatic "temperature watchman"—turning on the heat when the room cools off and shutting the heat off when the room warms up.

In some heating, ventilating, or air-conditioning systems it is desirable to govern the motor-operated equipment by manually operated switches. Barber-Colman apparatus is adaptable to this type of control as well as the automatic thermostatic control.

The shaft in the motor unit which moves the plunger also carries a set of cams which open and close various switches governing the motor-operator and other equipment. By means of one of them, for instance, the running current is shunted away from the thermostat immediately after the motor starts and this one also breaks the running current circuit at the proper time to stop the motor-operator positively when it has opened the valve or moved the damper to the required position. An auxiliary pair of cam-operated switches in the motor-operator can be used for governing other electrically-operated equipment, such as a motor-operated valve, or a relay to start a fan motor.

Thus the essential equipment of the Barber-Colman *Electric* System of Temperature Control is very simple. There is just the thermostat, and a valve on the radiator or a controller on the damper. The only other equipment required is a transformer and fuse block or circuit breaker to supply the required low-voltage alternating current on which the equipment operates. The Barber-Colman *Electric* System is the first complete, dependable and successful application of *electricity* to the work of uniform temperature control. A more detailed description of each piece of apparatus and descriptions of temperature control systems for various types of heating equipment will be found in the following pages.

F E A T U R E S

The Barber-Colman system has certain outstanding features which contribute to its superiority. These are summarized here and should be kept in mind when comparing the values of temperature control systems.

ALL-ELECTRIC

The entire system is operated by electricity —a steady and dependable carrier of power.

LOW-VOLTAGE WIRING

This assures low cost and ease of installation in new or existing buildings.

MOTOR-DRIVEN OPERATORS

An electric motor in each controller moves valves or dampers by positive mechanical means. Solid materials only—no gases or liquids—are used throughout the system.

INDUCTION MOTORS

Quiet operation of motor-driven units is assured. There are no brushes or commutators with their attendant troubles.
No radio interference is produced.

UNIT VALVE CONSTRUCTION

The motor unit can be separated from the radiator valve bonnet and the valve operated by an auxiliary hand wheel. Thus the heating system can be completed and tested before installing motor operators.

MINIMUM AUXILIARIES

An all-electric system requires only a few small and inexpensive auxiliaries.

APPEARANCE

Neat and attractive appearance has been stressed in the design of all units. Thermostats and valve operators occupy minimum space.

ALL-METAL THERMOSTATIC ELEMENTS

A bimetallic type of thermostat is used in which all parts are made of materials which will not deteriorate with time.

SPRING-LOADED VALVES

Valve disks are held against seats by spring pressure applied in the last part of the closing stroke. See description of valves, page 29. This insures uniform pressure and prevents undesirable wire-drawing action.

ADAPTABILITY

Equipment can be provided for all of the numerous types and varieties of heating, ventilating, and air conditioning systems within the pressure capacity of the equipment.

LOWER FIRST COST

Lower apparatus and installation prices prevail than for any equivalent system which will accomplish similar results.

LOW OPERATING COST

Power is used only as required for doing work, and the electrical auxiliaries have a low consumption rate, thus insuring minimum operation cost.

LOW MAINTENANCE COST

Very little maintenance is required on the equipment. It will perform dependably from day to day and season to season without attention.

FOR EXISTING BUILDINGS

There is nothing but low-voltage electric wiring to install in order to connect the parts of the equipment; this can be done almost as neatly and easily in most existing buildings as in one under construction.

TYPICAL APPLICATIONS

DIRECT RADIATION 10

UNIT HEATERS 12

UNIT VENTILATORS 13

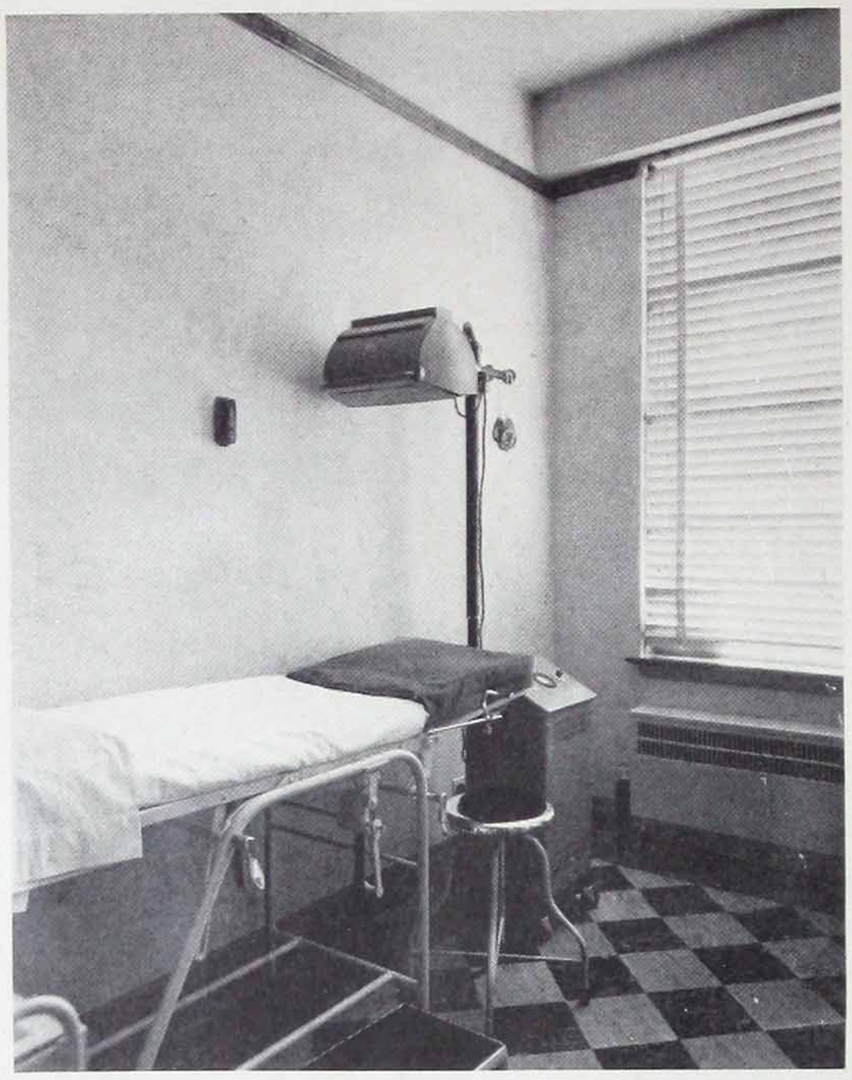
DIRECT-INDIRECT RADIATION 16

INDIRECT RADIATION 19

WARM AIR FURNACE 21

DIRECT RADIATION

Motor-Operated Valves



Direct Radiation with Valve and Thermostat in Physio-Therapy Treatment Room

IN a direct radiation system, where the radiators are set openly in a room or concealed by decorative covers or grill-work, the Barber-Colman controls will include a motor-operated valve on each radiator and a thermostat on the wall in each room. The thermostat will govern the action of all the valves in the room in which it is located, opening them when heat is called for and closing them when the thermostat is satisfied. In this way the radiator valves will be opened when the temperature of the air near the thermostat drops slightly below the set point and will be closed when the temperature rises. For a large room it is sometimes advisable to have several thermostats, each controlling a group of radiators, in order to keep a uniform temperature throughout the room.

Action of Thermostats

Grouped Radiation Control

Automatic Burner Control

For buildings which have an automatic control for the primary heat source, an especially advantageous arrangement can be made which is extremely economical and will give closely controlled temperature in all the rooms. Motor-operated valves are installed on all radiators in each room and the last valve of the series has its auxiliary contacts connected to a relay in such a manner that when any valve or any number of valves are opened the burner starts. The burner stops when all valves in the building have been closed. This insures a supply of heat whenever and wherever it is called for by the thermostats and will give considerably better regulated temperature throughout than the common arrangement whereby the burner is controlled solely by one centrally located thermostat. This is an excellent type of installation for most apartments and large homes.

Relay to Burner

For Apartments

Partial Relay Control

A variation of this arrangement is to select certain valves in the building and connect them up with the relay control so that only these "key" valves control the operation of the automatic burner. This is somewhat less expensive than a relay control from each room but does not offer as close control throughout the building. The Barber-Colman relay system replaces the single thermostat and retains the safety controls.

Heat Sources for Relay Control

Gas burners, oil burners, automatic stokers, furnace damper regulators, and valves on steam mains from central heating plants can be controlled by the same kind of installation.

For Apartments

The Barber-Colman Electric System of Temperature Control has a number of advantages for apartment buildings, and there are several ways of installing the system. The most complete system includes a valve on each radiator in the apartment and a thermostat in each room controlling the valves in that room. If the apartment is fairly compact, and the radiation well balanced, one thermostat may be placed in a central location in each apartment to control all the valves on the radiators in the various rooms in that apartment, or one valve on the steam supply for the suite.

Individual Room Control

Suite Control

Riser or Zone Control

Another method uses a line valve on each riser and a thermostat on one of the floors within the area served by that riser to control this valve. Still another variation is to locate line valves and thermostats at strategic points throughout the building to give a type of zone control.

Relay Control in Apartments

In all cases the relay arrangement described above for an automatic burner may be used if such a burner is installed in the heating system. The cost of these various types of installation varies, of course, directly with the amount of equipment installed, so that the first of those described would be the most expensive but, at the same time, would give the most uniform control.

Cost vs. Control

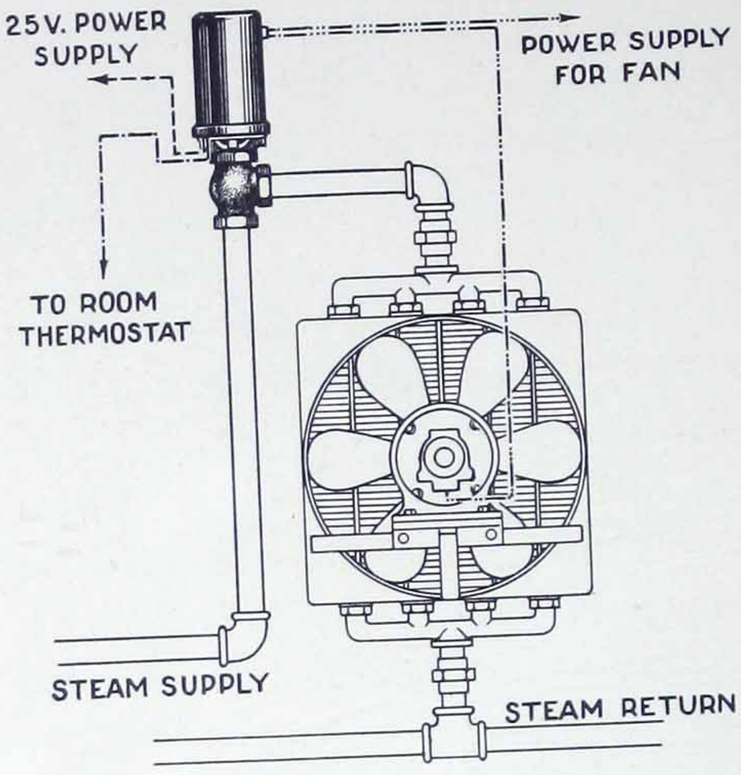
Zone Control of Buildings

Some buildings have an arrangement called "zone control." A motor-operated line valve is installed on the main supplying a riser or several risers, which carry steam to a vertical section of the building, this valve being controlled by a thermostat strategically placed in one of the rooms whose radiation is served by that riser. Other combinations of valves, relays, thermostats, etc., may be devised to take care of such conditions as exist. A system of zone control will give only a fairly uniform temperature throughout the building and is justified only by its lower cost. Full individual room control is, without doubt, the most satisfactory.

UNIT HEATERS

Unit Heater Defined

A Unit Heater generally consists of a steam heating element with a fan to force air past the heating unit, vanes to direct the flow of the discharge, and occasionally a damper to control the intake when outside air is being used. The Barber-Colman system of temperature control may be installed as follows:



Location of Thermostat

A room thermostat is placed in a suitable location and set to maintain the desired room temperature.

Valve and Fan Control

This thermostat will govern the admission of steam to the heating coil by actuating a motor-operated valve, and through an auxiliary switch, will start the fan when the valve is opened and stop it when the valve closes. This combination control of the valve and the fan is desirable as the life of fan motors on these units may be considerably shortened if steam is not turned off at the same time as the fan.

Thermostat in Return Line to Prevent Cold Blast

A surface or immersion thermostat may be placed in the return line from the unit heater and wired and set so that the fan will not start unless the steam return line is warm. This obviates the possibility of a cold blast of air should the steam happen to be turned off the heater when the valve opens.

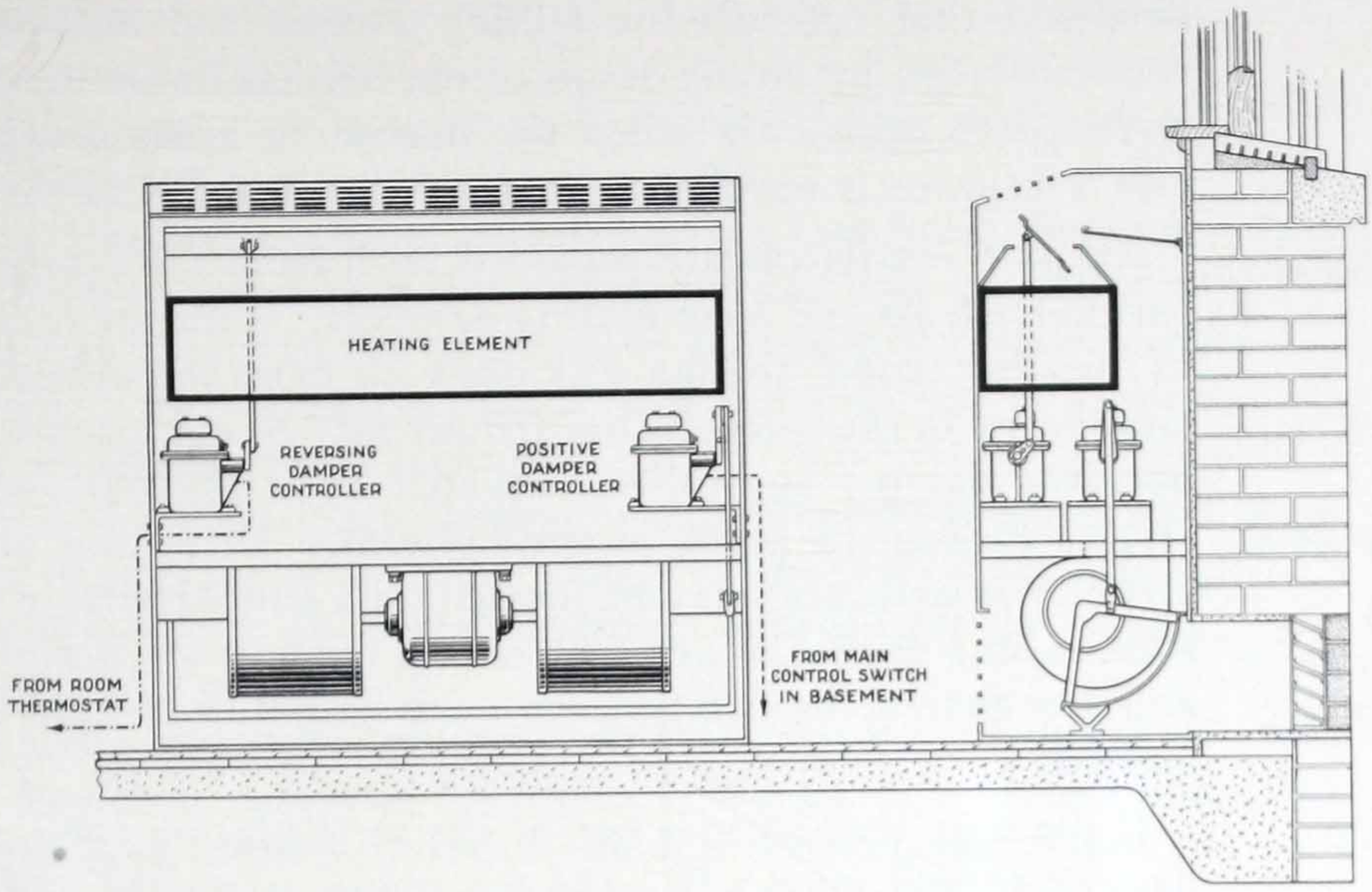
Intake Damper Control

When the unit heater is connected to a duct through which outside air is drawn it is advisable in severe climates to install a positive motor-operated damper controller on a damper at the intake of the duct. This may be operated by a relay switch so that the damper will be closed when the fan is stopped and the steam shut off. Such an arrangement prevents cold air blowing in through an open duct.

Fan Control Only

Another arrangement can be used where it is desired to control only the fan on the unit heater without controlling the steam supply to the coil. In this arrangement the thermostat, instead of being wired to the valve, is connected to a relay box which will stop or start the fan motor as less or more heat is called for. Thus, when the fan is running, warmed air will be circulated; while the fan is stopped, the coils of the unit heater will be hot, but the warmed air will be given no forced circulation.

UNIT VENTILATORS



Definition and Operation of Unit Ventilator

THE unit ventilator is a device designed to accomplish both heating and ventilation and is generally of a form similar to that shown in the illustration. The amount of air to be passed over the heating element and the amount to be by-passed directly into the room is determined by the position of the mixing damper shown above the heating element in the illustration. A Barber-Colman system for controlling such a unit ventilator is installed in the following manner:

Location of Thermostat

A room thermostat is placed on the wall opposite the unit ventilator and this thermostat controls a motor-operated reversing damper controller which moves the mixing damper very slowly back and forth, depending upon whether the thermostat is calling for more heat or less heat. When the air near the thermostat has reached the exact temperature at which the thermostat is set, the mixing damper will remain stationary in whatever position it happens to be at the time.

Floating Damper Action

Steam Valve Control

When it is desirable to control the steam supply valve on the heating element of the unit ventilator, as well as the mixing damper, the control of this valve is arranged in such a manner that it is open only when the mixing damper is open. In other words, when the mixing damper reaches the position where all of the air is by-passed around the heating element, the steam valve closes.

Additional Direct Radiation

Ordinarily one or two direct radiators are installed to assist the

unit ventilator in severe weather. These are controlled by the *same thermostat* that controls the mixing damper and heating element of the ventilator, by means of motor-operated radiator valves which are arranged to open only when the maximum heating capacity of the unit ventilator is insufficient to meet the demands of the thermostat.

Intake Damper

All unit ventilators are provided with fresh air dampers or combination fresh air and recirculating dampers. With the latter, as shown in the illustration, the fan may draw air from the outside, or recirculate the air in the room. This damper may be equipped with a motor-operated damper controller, actuated by a manual switch located

Manual Switch Control

at any convenient point in the building. In School buildings this switch (or switches) may be located on a panel board in the janitor's room, along with a switch controlling the unit ventilator fan motors, and can govern the dampers for a whole group of unit ventilators if desired.

Fresh Air Damper

If the unit ventilator is not of the recirculating type, the fresh air damper should open when the fan motor is started and close when the fan motor is stopped. This can be readily accomplished with the Barber-Colman controls by wiring the fresh air damper controller to the fan motor switch, through a relay, so that one switch governs both the fan and the fresh air damper. This arrangement eliminates the possibility of neglecting to close the fresh air damper when the unit ventilator is not in use, and insures opening of the damper when the fan starts.

Unit Control System

By using the power supply available in the unit ventilator as a source of power for the Barber-Colman system, the control equipment in any one room may be independent of the equipment in any other room; this will effect a minimum in installation costs, and a maximum in simplicity of installation and flexibility of operation.

Control of Double Heating Element Type

The Barber-Colman system is also applicable to the type of unit ventilator having a double heating element but no mixing damper. Equipment for controlling such a unit ventilator is installed in the following manner:

Heating Element Valves

The two heating elements in the unit ventilator are provided with motor-operated reversing valves controlled by a thermostat. A call for heat by the thermostat will cause one of the two motor-operated valves to open *slowly* and continue to open until the demands of the thermostat are satisfied. If the thermostat is satisfied before this valve

Second Heating Element

reaches the wide open position, the valve will remain stationary in

whatever position it happens to be at the time. Only when the one heating element is insufficient to meet the demands of the thermostat will the second motor-operated valve allow steam to enter the second heating element, and then only in such amounts as are necessary to maintain the desired temperature in the room.

Pilotstat for Minimum Temperature

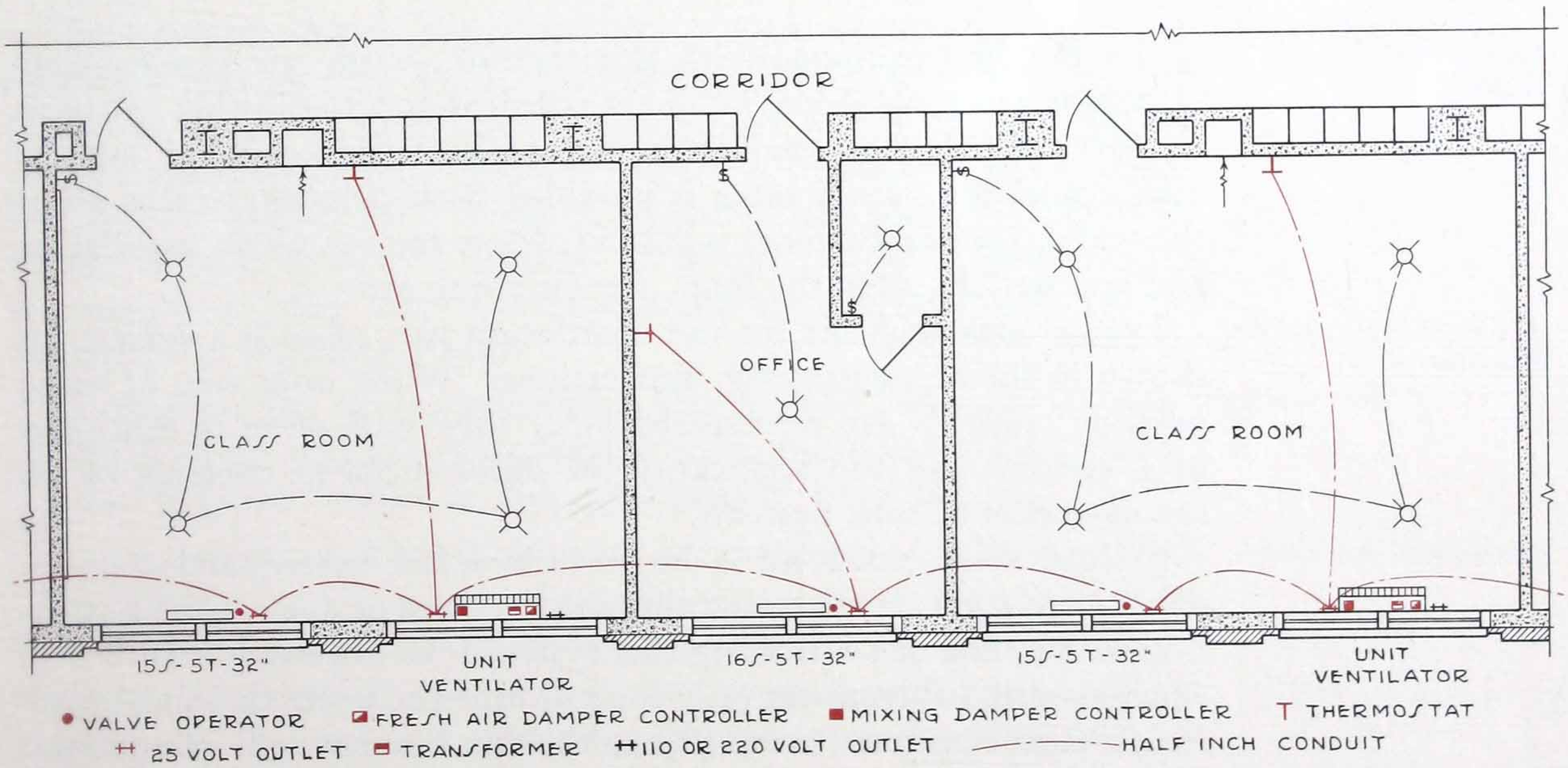
In addition, a pilotstat (this being essentially a low-limit governing thermostat) may be installed inside the case of the unit ventilator in such a manner as to govern the minimum temperature of the air being forced into the room, insuring that cold drafts will not be caused when the room thermostat is satisfied.

Fresh Air or Recirculating Damper Control

The control of the fresh air damper, or combination fresh air and recirculating damper, as well as the control of auxiliary direct radiation, is accomplished in the same manner as outlined for the mixing damper type of unit ventilator.

Other Types

There are many other types of unit ventilators, having combinations of heating elements, dampers, valves, etc., which do not function exactly as the ones mentioned above, though their purpose—that of room heating and ventilation—is the same. Barber-Colman equipment can be supplied to govern *all* types of unit ventilators and inquiries are invited concerning any such special applications.



Unit Ventilators in a Modern School.
Reproduction of part of an architect's drawing, showing conduit layout for Barber-Colman equipment

DIRECT-INDIRECT RADIATION
"SPLIT SYSTEM"

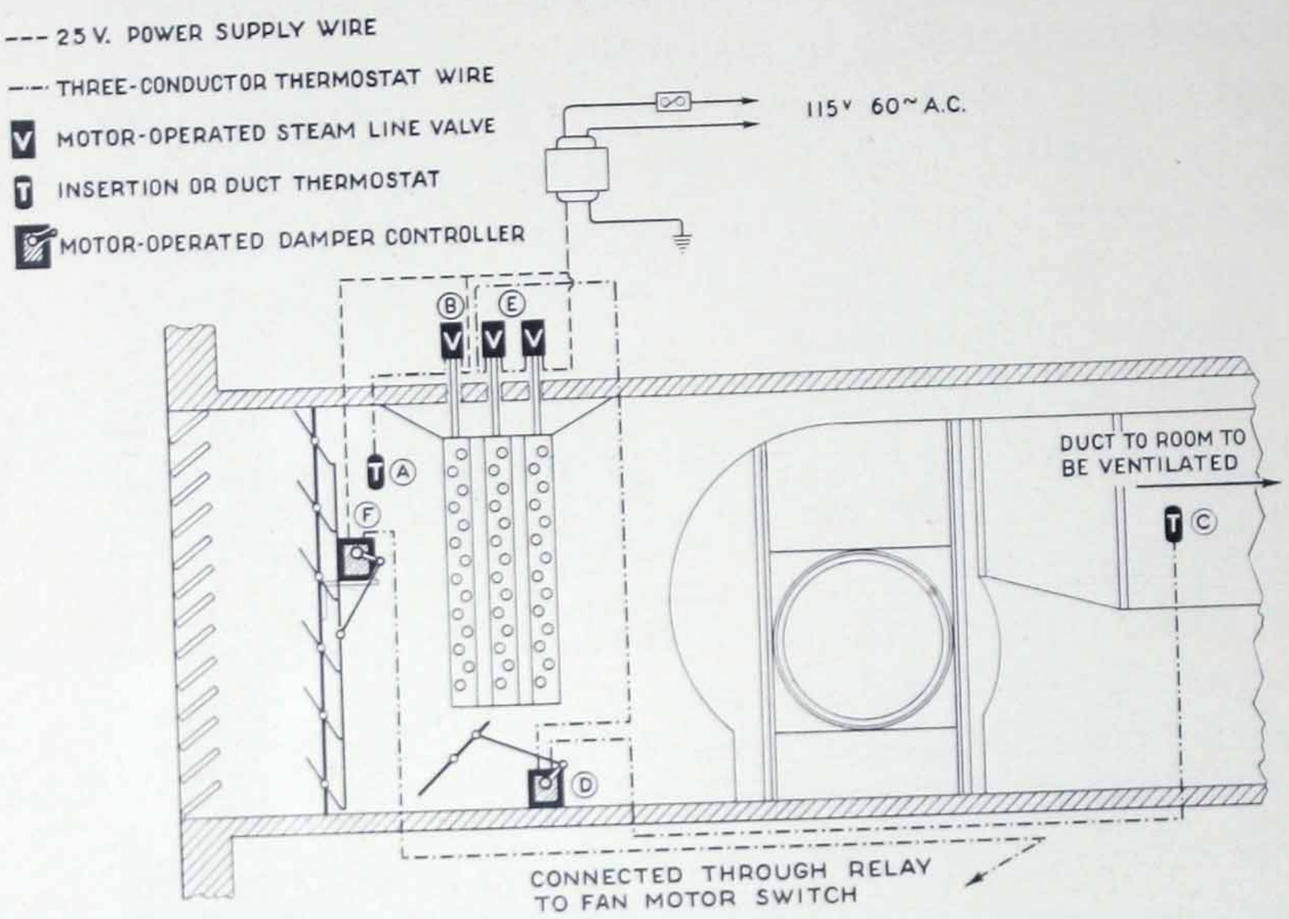


Illustration No. 1

Split System Defined

IN a building equipped with this type of system, air at a constant temperature of about 70° F. is supplied for ventilation purposes only; the heating requirements of the building being met by direct radiation. Each room is provided with radiators placed along the walls, preferably under windows; inlets for the warm ventilating air; and outlets, near the floor, for outgoing air.

Treatment of Air for Ventilation

Typical arrangements for the ventilating part of such a system are shown in the accompanying illustrations. While only two of many possible methods are represented here, they will serve to illustrate in a general way the application of Barber-Colman controls to all arrangements of Split Systems.

Illustration No. 1

In illustration No. 1, air is drawn in by a fan, heated, and then distributed to the various rooms through a system of ducts. The Barber-Colman method of controlling this system is as follows:

First Heating Coil

An insertion thermostat (A), located near the fresh air intake, controls a motor-operated valve (B) on the first heating coil. To prevent damage to coils as a result of freezing, thermostat (A) is usually set to open valve (B) at about 35° F. Insertion thermostat (C), located near the discharge end of the fan, controls a reversing damper con-

By-Pass Damper and Additional Coils

troller (D) attached to the by-pass damper under the heating coils. Motor-operated valves (E) on the second and third heating coils are also controlled by thermostat (C) through auxiliary contacts on the damper controller. The desired final temperature at the discharge end of the fan is maintained in the following manner:

Operation of Coil and Damper Controls

Valve (B) will open only when the outside temperature drops to 35° F. or less. A call for heat by thermostat (C) will cause the by-pass damper to close relatively fast. When the by-pass damper reaches the closed position, valve (E), on the second heating coil, will begin to open slowly and continue to open as long as the by-pass damper remains closed, that is, as long as thermostat (C) calls for heat. As soon as the demands of thermostat (C) are satisfied, the by-pass damper will begin to open, and *simultaneously* the valve operator on the second coil will *stop* and remain in a throttled position, unless the by-pass damper becomes wide open or closed again, whereupon the valve on the second coil will immediately begin to move *slowly*. The valve on the third coil will begin to open *slowly* only when the demand for heat by thermostat (C) is sufficient to keep the by-pass damper closed long enough to enable the valve on the second coil to become wide open.

Second Heating Coil

Third Heating Coil

Fresh Air Damper Control

The fresh air damper is actuated by a motor-operated damper controller (F), controlled by the fan motor starting switch, through a relay, in a manner such that when the fan is started the fresh air damper opens, and when the fan is stopped the fresh air damper closes. Damper controllers may be mounted inside the duct and connected to the damper through a linkage, as shown by the illustration, or, if convenient, they may be mounted outside the duct and directly connected to the damper shaft.

Illustration No. 2

Illustration No. 2 shows another arrangement for a Split System in which an air washer is incorporated. The application of the Barber-Colman Electric System to this arrangement is as follows:

First Heating Coil

An insertion or duct thermostat (C) controls a motor-operated valve (D) on the first coil of the primary heater. (Note that no by-pass damper is shown under the primary heating coils. It is undesirable because of stratification). One or more additional insertion thermostats (A) will, by controlling motor-operated valves (B), cut in more heating surface as required by the temperature of the outside air. After being tempered, the air passes through an air washer (E). An insertion thermostat (F) controls the by-pass damper underneath

Second and Third Coils

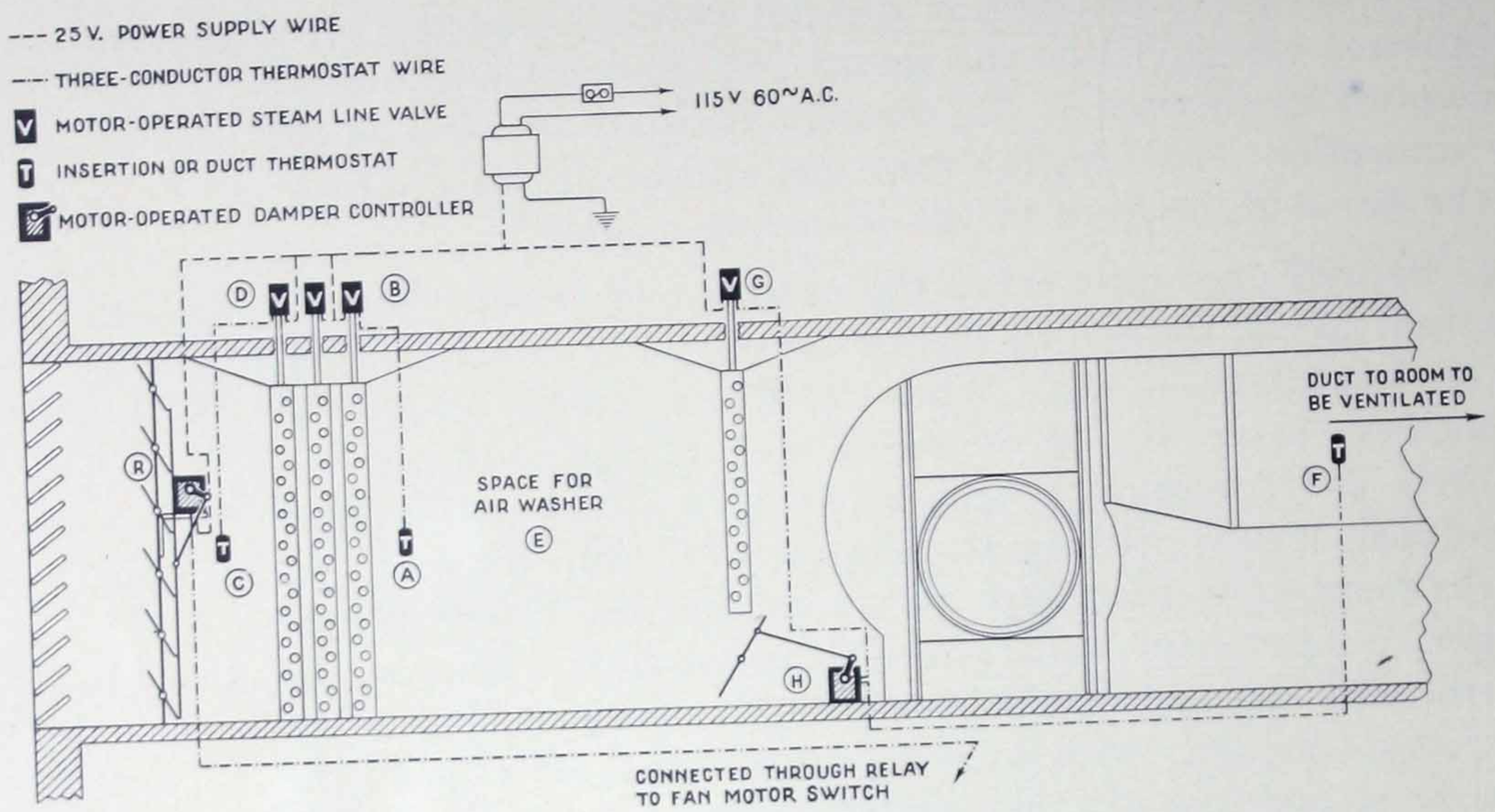


Illustration No. 2

By-Pass Damper and Reheating Coil

the reheating coil through a motor-operated damper controller (H) which in turn operates the motor-operated steam valve (G) on the reheating coil, to maintain the desired final temperature. Motor-operated valve (G), which operates *slowly*, will remain stationary (it may be wide open, completely closed, or in a throttled position) as long as the by-pass damper, which operates relatively fast, "floats" between its wide open and completely closed positions. In other words, the by-pass damper controller acts as a limit switch which, when the by-pass damper reaches its maximum cooling position, cuts off the steam supply to the reheating coil, *slowly*, and when the by-pass damper reaches its maximum heating position, opens the steam valve to the reheating coil, *slowly*.

Valve Actuated from Damper Controller

Intake and Exhaust Damper Control

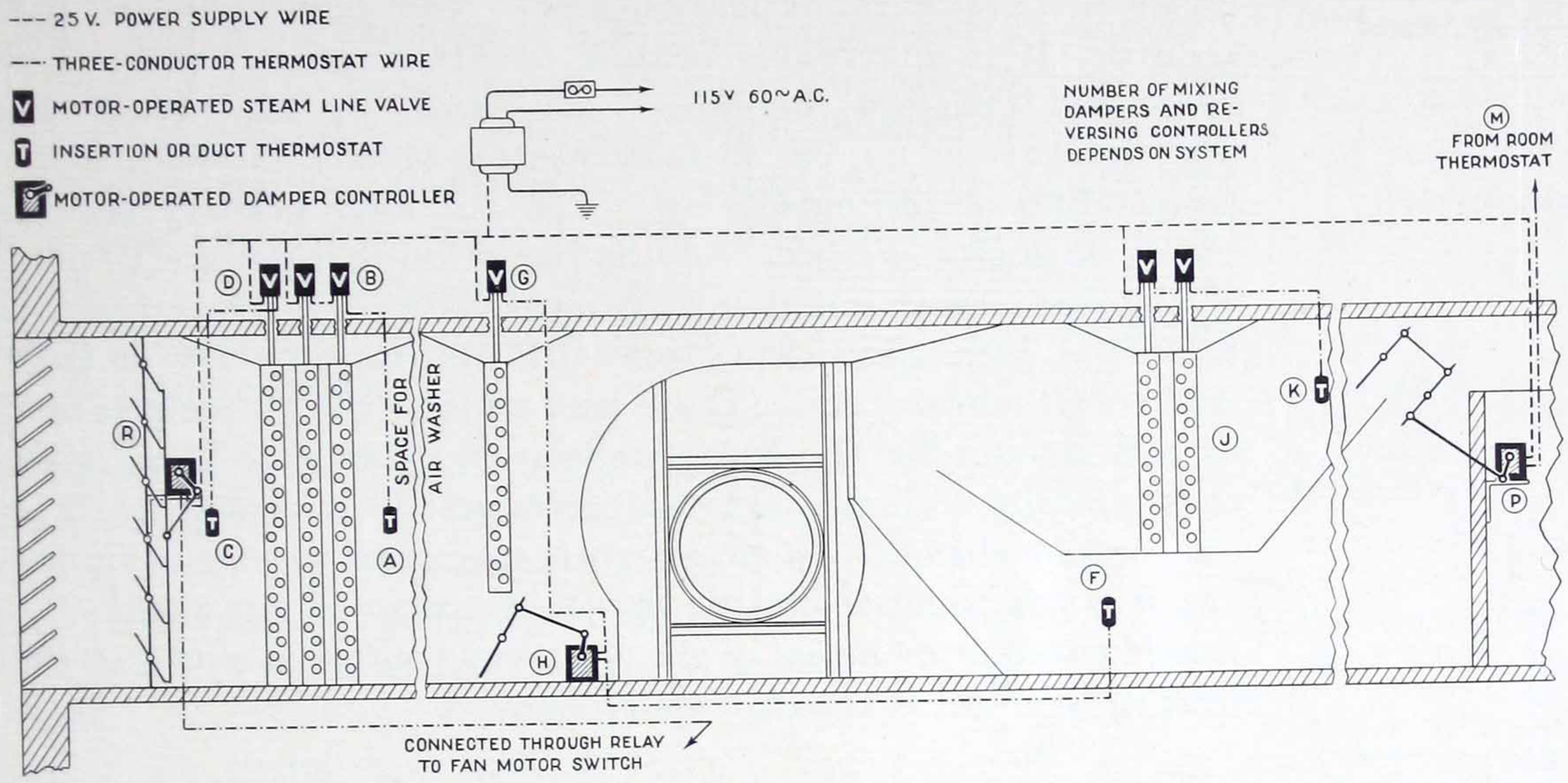
The fresh air damper is actuated by a motor-operated damper controller (R) controlled by the fan motor starting switch, through a relay, in a manner such that when the fan is started the fresh air damper opens, and when the fan is stopped the fresh air damper closes. Exhaust dampers may be controlled in a similar manner.

Direct Radiation for Heating

In both illustrations of Split Systems herein described, the heating of the rooms is taken care of by direct radiators, controlled by room thermostats and motor-operated valves as described under "Direct Radiation."

INDIRECT RADIATION

"PLENUM SYSTEM"



Adaptability of Controls

THERE are so many different forms and modifications of indirect radiation systems that it is impractical to discuss all of them here, but it will be shown that a Barber-Colman temperature control system can be supplied to govern practically any arrangement. Perhaps by considering one containing the typical units a good idea may be obtained of the various controls that are necessary. The system will vary according to the requirements and conditions of the building.

Definition of Indirect Radiation

Indirect radiation consists, in general, of steam coils which are usually some distance from the rooms to be heated. Air is drawn or blown over the surface of these coils, heated, carried through ducts to the various rooms, and there discharged.

A Full Blast System

A common type of full blast heating system is shown in the accompanying diagram in which the air, drawn in by a fan, is first tempered, then washed, then reheated. After passing the fan the warmed air is divided between two chambers, in one of which it is again reheated. Each room duct receives air as required from both of these chambers, the amount from each being controlled by mixing dampers. An

Explanation of Illustration

arrangement of Barber-Colman apparatus to give satisfactory control on such a system would be as follows:

Arrangement of Barber-Colman Controls for Full Blast System

An insertion thermostat (C) controls a motor-operated valve (D) on the first coil of the primary heater. (Note that no by-pass damper is used. It is undesirable because of stratification.) One or more additional insertion thermostats (A) will, by controlling motor-operated valves (B), cut in more heating surface as required by the temperature of the outside air. The air, after primary tempering, passes through a washer. Another insertion thermostat (F) controls the by-pass damper and motor-operated valve (G) in exactly the same manner as outlined in connection with illustration No. 2 on page 18.

Tempering Coils

Reheater

Additional reheater coils (J) are used to raise the air temperature the desired amount for the high temperature chamber. These coils are controlled by a single insertion thermostat (K) located in the high temperature chamber. Some designers prefer not to control these coils and it is not essential because the air temperature just ahead of them is held constant by means of the preceding controls and the amount of heat to be added is therefore quite definite.

Mixing Dampers

In order to obtain the proper temperature of air in the ducts, there is a room thermostat (M) in each room controlling a motor-operated reversing damper controller (P) which is attached to the mixing damper at the beginning of the room duct.

Intake and Exhaust Damper Controller

The fresh air damper is actuated by a motor-operated damper controller (R) controlled by the fan motor starting switch, through a relay, in a manner such that when the fan is started the fresh air damper opens, and when the fan is stopped the fresh air damper closes. Exhaust dampers may be controlled in a similar manner.

With this arrangement of control apparatus, the temperature of the air at all points in the system is uniformly and automatically maintained. It will be noted that Barber-Colman equipment is made in such units that it may be applied to any variation or subdivision of a full blast system.

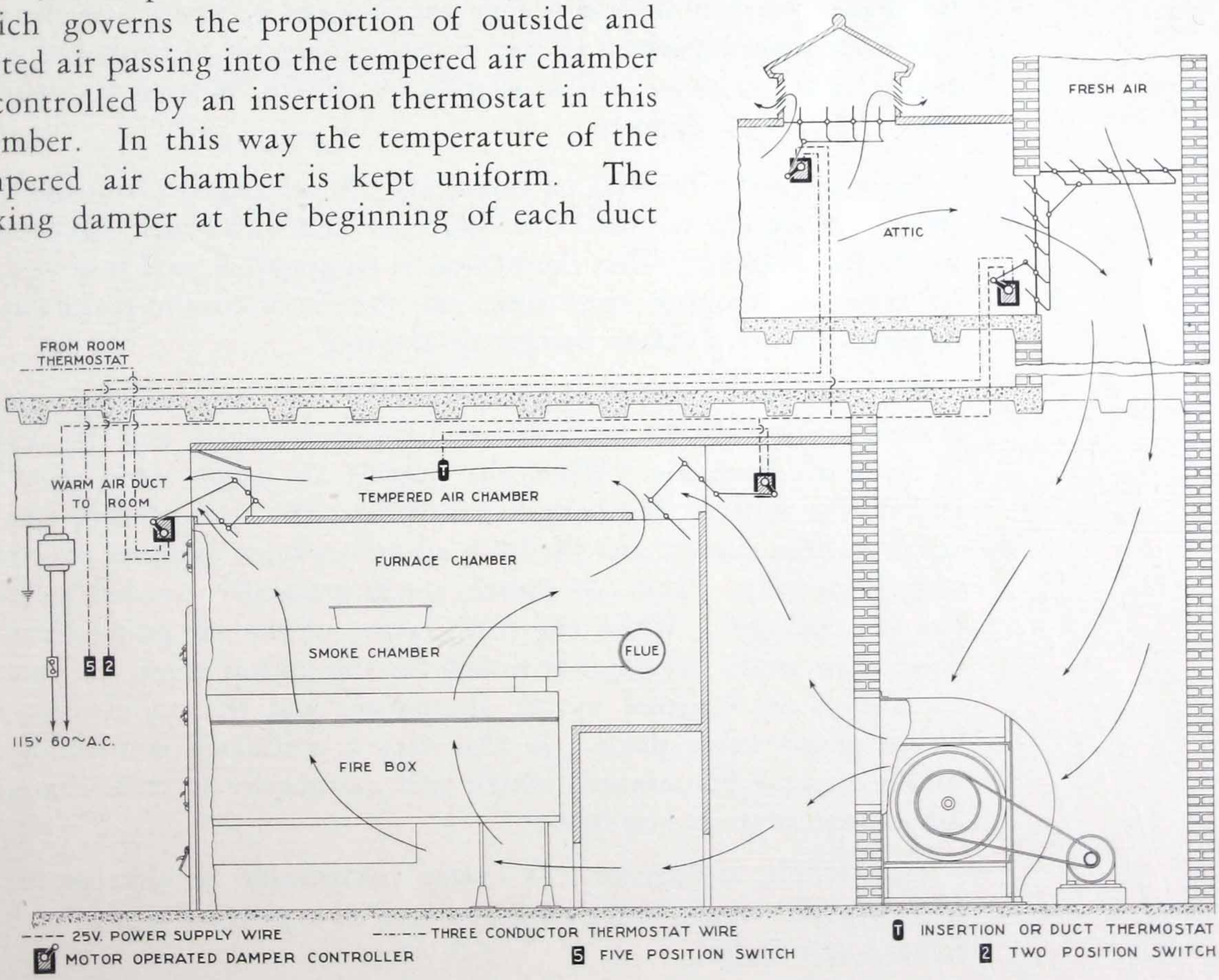
WARM AIR FURNACE
"BLAST SYSTEM"

Purpose of System

IN many heating system installations utilizing the full blast principle, a warm air furnace is used, the construction of which is similar to that shown in the accompanying illustration. The purpose of such a heating system is to supply warmed air to each of the rooms in a building in a sufficient quantity and at such a temperature to keep the rooms warm. The warm air is the only source of heat, there being no auxiliary radiation of any kind. This means that the air put into the room must vary in temperature depending upon outside conditions.

As indicated in the illustration of the furnace below, the position of the mixing damper which governs the proportion of outside and heated air passing into the tempered air chamber is controlled by an insertion thermostat in this chamber. In this way the temperature of the tempered air chamber is kept uniform. The mixing damper at the beginning of each duct

Arrangement of Dampers for Controlling Circulation of Air in Furnace



determines how much hot air from the firebox chamber and how much warm air from the tempered air chamber shall be admitted to the duct to give the proper temperature of air as required by the thermostat in the individual room which that duct serves.

Control of Air to Room

The actual temperature of the air forced into a room is controlled by a room thermostat connected to a slow-acting reversing damper controller on the mixing damper which is installed at the point where the warm air duct for that room leaves the furnace.

Manual Control of Intake Air

In order to control the mixture of fresh and recirculated air a manually operated 5-position switch is mounted at or near the furnace. This switch governs a positioning damper controller which controls the positions of the fresh air and recirculating dampers, the connections being made so that when one of these is wide open the other is completely closed. This switch is set, by the engineer in charge, to the proper position determined by weather and occupancy conditions. The arrangement permits of five different mixtures of fresh and recirculated air. A two-position switch, as shown, is used to open or close the exhaust damper.

Automatic Control of Intake Air

An alternative method of arranging the automatic controls (not shown in the illustration) is to place an insertion (duct) thermostat in the fan chamber. This thermostat is set to 40° F. and is connected to reversing damper controllers on the fresh-air-and-recirculating dampers and the exhaust damper on the roof.

With outside air temperature above 40° F., the recirculating damper is closed, the fresh air and exhaust dampers are open, and the system is using all fresh air. When the outside air drops below 40°, the thermostat actuates the damper controllers, the recirculating damper starts to open slowly, and the fresh air and exhaust dampers are closed proportionately. This, of course, sends gradually warmer air into the fan chamber. When the temperature of the air going through there has risen to the point at which the thermostat is set, the damper controllers are reversed by the thermostat and the opposite of the above action takes place. In this way a graduated control of the intake air may be obtained which will automatically meet changing outside temperature conditions.

This whole arrangement is nearly comparable to that of a full blast system, where steam coils are used as a primary source of heat instead of a firebox.

TEMPERATURE CONTROL EQUIPMENT

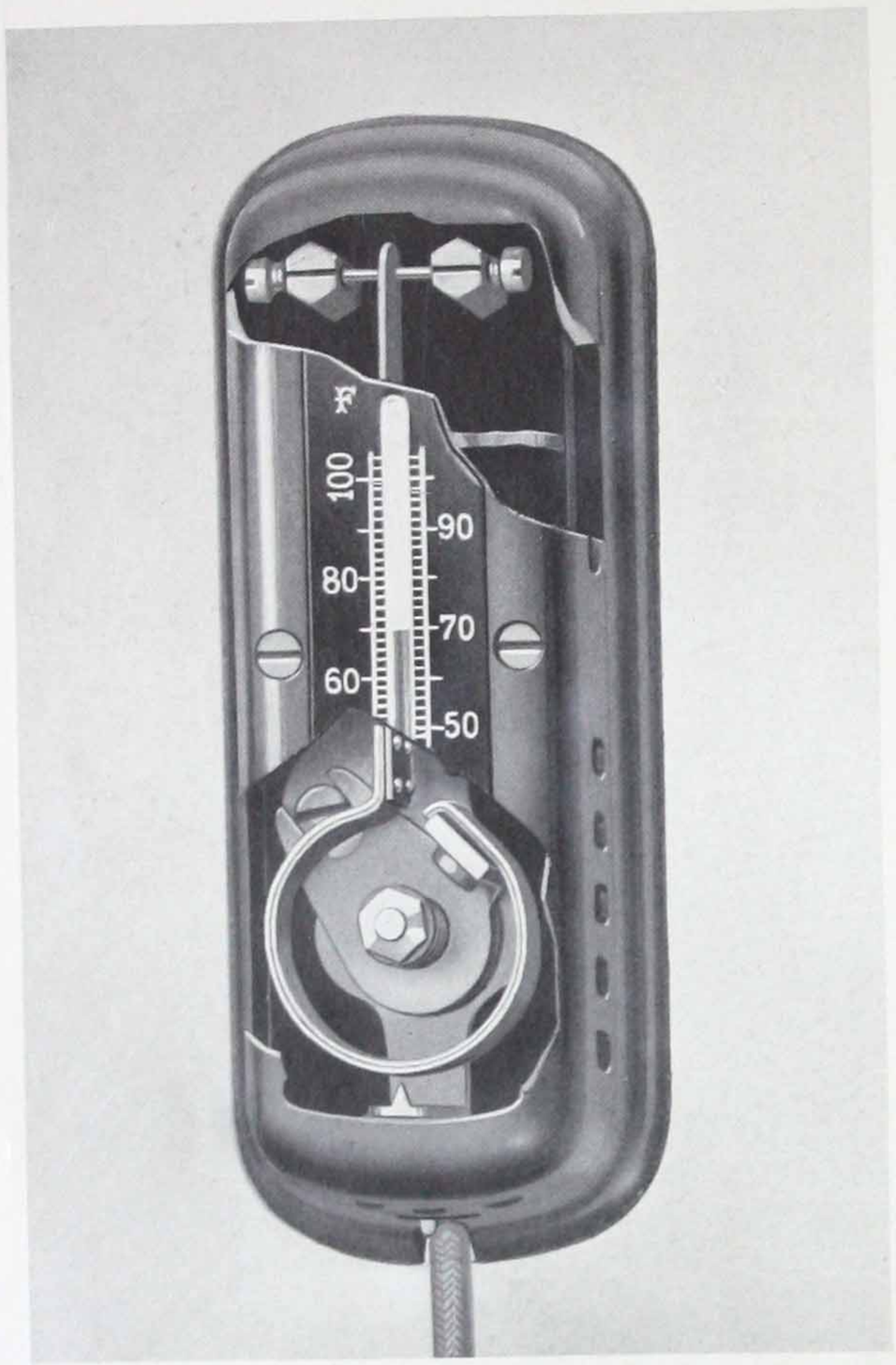
THERMOSTATS 24

VALVES 29

DAMPER CONTROLLERS 33

MOTORS 36

ROOM THERMOSTATS

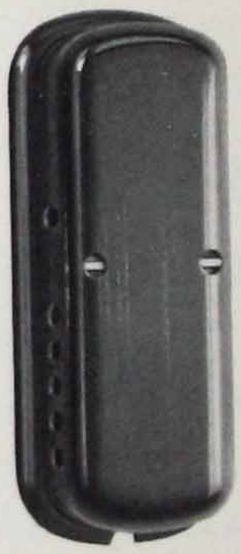


Standard Room Thermostat.
Cover Broken Away to Show Contact Points
and Bimetallic Loop

BARBER-COLMAN Room Thermostats are of the three wire, low voltage, open contact type. The working parts are housed in a moulded case of attractive design, the contact points being enclosed in a dust-tight compartment. The base of the instrument, to which the metal parts are fastened, is also moulded phenolic resin. This construction permits the thermostats to be mounted on any type of wall or column and acts as insulation against heat and electricity. No extra mounting block of insulating material is required.

An accurate thermometer is mounted on the cover of each thermostat and the scale of the thermostat is calibrated to agree with the scale of the thermometer. Room thermostats have a standard range of from 60° F. to 80° F., and can be made for other ranges when required for special types of installations.

These thermostats are sufficiently sensitive to actuate the controlled mechanism on a total temperature variation of less than 2° F. at the thermostat. A pointer on the scale at the bottom of the cover may be set for the desired temperature. The thermostat will then cause the radiator valve (or other mechanism) to open when the temperature at the thermostat drops 1° F. below the point at which it is set and will close the valve when the temperature at the thermostat rises 1° F. above the set point.

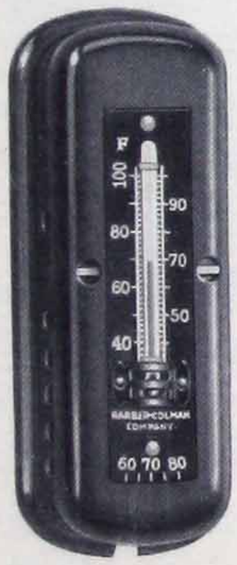


Room Thermostat. No Thermometer, Internal Adjustment, Special Cover Screws

The sensitive element of the thermostat is a bimetallic loop which has one end adjustably mounted and the other end fastened to a tongue, the end of which is free between two fixed contact points. Changes in temperature cause the loop to expand or contract and the tongue is moved until it

makes contact with one or the other of the points. Making contact with the right-hand point completes a circuit to open the valve; contact with the left-hand point will close the valve. When the pointer of the thermostat is shifted, it moves the adjustable end of the bimetallic loop so that the arc of action of the tongue is transferred to a higher or lower temperature range. Thus the mechanism of this temperature governing instrument is extremely simple and effective.

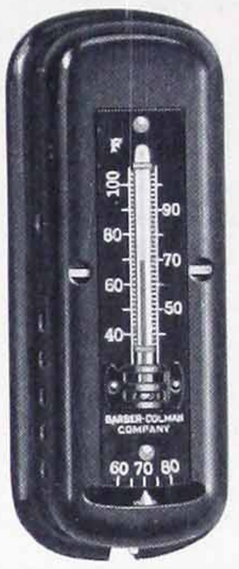
There are some variations of the Standard Room Thermostat, any of which can be supplied to meet certain special conditions. For instance, in a schoolroom, it may be desirable to have the thermostat arranged so that the existing temperature can be read but no change made in the setting of the thermostat. In other locations, it is unnecessary to have either a thermometer or an external adjustment. For these purposes, thermostats with a thermometer on the cover and the setting lever and scale concealed within the case, or with no thermometer and the internal adjustment, may be supplied. In addition, special cover screws can be used which require a special key for removal.



Room Thermostat. With Thermometer, Internal Adjustment, Special Cover Screws

The Detent type is another variation of the standard room thermostat and is intended for use where vibration is serious. Two small magnets are mounted inside the case, one on each side of the tongue. The effect is to hold the tongue positively against one contact point until it is ready to snap over against the other one. Detents may be included in any of the various types of thermostats when required.

When it is desirable to limit the range within which the adjusting lever, or setting point, of the thermostat may be moved, stops may be set within the case of the instrument. They can be set as desired and are completely effective. Conditions requiring this treatment are found where persons having access to the thermostat do not understand its functions sufficiently and are liable to move the adjusting lever from one end of the scale to the other indiscriminately, a practice which is not necessary and very undesirable.



Room Thermostat. With Thermometer, External Adjustment, Special Cover Screws

Another special variation of the Room Thermostat is made for use in rooms where it may be desired to turn off the source of heat completely for a time. For instance, in a bedroom it is often desirable to shut off the radiators completely during the night. This special thermostat is made so that when the adjusting lever is pushed to the left as far as it will go, the tongue is pushed against the "blue" contact (which denotes "sufficient heat") and held there firmly without allowing the contraction of the bimetallic loop to pull it away. In this way the valves are kept closed as long as desired. A similar arrangement the other way—one that will keep the valves open all the time—can also be made when necessary.

TWO-TEMPERATURE THERMOSTATS

IN many buildings it is desirable to hold the whole building or parts of it at a lower temperature during the night than in the day time. This can be accomplished by the use of Two-Temperature Thermostats.

A Two-Temperature Thermostat consists essentially of two complete standard room thermostat units in one case, having a separate setting scale and range for each of the two units. A switch inside the case, actuated by magnets or by a manual lever protruding from the case, determines which of the two thermostat units shall govern the valves in the room.



Two-Temperature Thermostat

A manual switch, or a program switch if there are a large number of rooms in the building, is located in some strategic place such as the engineer's office and by means of this all of the thermostats in the building can be put onto the day or night range as desired. This central control shifts the various thermostats by means of the magnet-operated switch inside the case. In addition, on each thermostat there is a means by which the unit can be put onto either day or night range by the occupant of the room at any time. This is convenient if a room is to be occupied during the evening when the rest of the building has been put on night temperature.

The scale on the thermostat unit controlling the night range is generally calibrated between 50° F. and 70° F. and the day range scale reads from 60° F. to 80° F. like the standard room thermostat. Limiting stops, detents, special cover screws, and concealed internal adjustments can be supplied for these units as for the regular room thermostats. In addition, if it is desirable, a system of signal lights can be installed to indicate the range on which the thermostats are operating. Two-Temperature Thermostats use the regular 25-volt, 60-cycle, alternating current for actuating the magnets so that no special type of wiring or power is required.

DUPLEX THERMOSTATS

This type of instrument consists of two complete Room Thermostat elements mounted side by side in a single case. The arrangement is similar to the two-temperature type except that there is no magnetic and manual switching means within the case to throw the control from one unit to another. An external switching means for each thermostat is required when the Duplex is used as a two-temperature thermostat. The instrument may be used for various purposes requiring double-

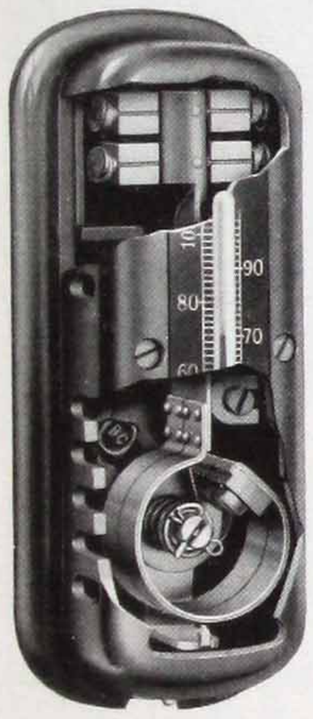


Duplex Thermostat. Two Standard Units in One Case

range or compound control and is made up with ranges on the two units suited to the requirements.

COMPOUND THERMOSTATS

IN school buildings it is sometimes desirable to arrange the temperature control system so that unit heaters or unit ventilators will keep the rooms, for example, between 71° F. and 73° F. Then, when conditions are such that the unit ventilators are incapable of keeping up this temperature, direct radiation is cut in for adding heat when the room temperature drops below 71° F. For such a purpose, where it is desirable to control two circuits from one instrument a Compound Thermostat is a useful device which will give accurate control on both circuits. Under some circumstances, the Duplex Thermostat described previously may be used, though its purpose is generally more in the nature of two-temperature control.



Compound Thermostat. Cover Broken Away to Show Contact Points

The Compound Thermostat consists of two sets of flexibly mounted and adjustable contact points in place of the one set used in the standard room thermostat. However, since both sets are on one tongue, the difference between the governing temperatures of the two sets of contacts cannot exceed 4° F.

INSERTION AND IMMERSION THERMOSTATS

THE principal uses for Insertion Thermostats are in such places as the air ducts of an indirect heating system. Immersion Thermostats are used in all kinds of pipes and tanks. The two types are similar in construction except that the protector tube of the insertion type, which is generally used in gases, is perforated, while the protector tube of the immersion type is solid.



Insertion ("Duct") Thermostat with 20° range. Immersion Thermostat has solid protector tube.

The principle upon which these thermostats operate is the same as that of the room thermostats described previously except that the bimetallic loop, instead of being a segment of a circle, is much longer and is formed into a helix which is supported inside the protector tube and solidly mount-

ed at the end nearest the case and the operating rod attached to the other end of the bimetallic helix extends through the center of the instrument and to the outside of the duct, pipe or tank. A moulded case insulates the tongue and contact points thermally and electrically.

These thermostats can be supplied in two styles, the first having a range of 20° F. between the high and low points on the scale and the second having a range of 120 °F. The 20° range is shown on the thermostat illustrated. These styles can be supplied for a 20° F. or a 120° F. range anywhere between 0° F. and 250° F. In addition, a special high temperature model is available which can be supplied with a 120 F°. range between 250° F. and 500° F. Thermometers are not provided on the covers of these instruments, but the setting scales are accurately calibrated.

Standard protector tubes are 5″ long but any lengths between 5″ and 8″ can be furnished on special order. All protector tubes are threaded at the case end with standard ¾″ pipe thread.

HYGROSTAT

THIS is an instrument for controlling the relative humidity in a room by governing the action of a humidifier. The sensitive element of the Hygrostat is a tube of special wood so arranged as to expose the maximum amount of end grain to the surrounding atmosphere, thus obtaining the greatest amount of expansion or contraction in the wood. As this piece of wood expands or contracts with changes in the relative humidity, it moves a tongue from one to the other of two fixed contact points in the same manner as does the bimetallic loop in a standard room thermostat. Thus the Hygrostat is of the three wire, open contact type and consequently may be used to govern motor-operated valves or damper controllers on humidifiers and their auxiliary equipment.



Hygrostat To Indicate and Control Relative Humidity

The scale on this instrument reads between 30% and 70% relative humidity, and the unit is calibrated at 40%. It will actuate a controlled mechanism on a variation of less than 4% in relative humidity at the hygrostat.

In addition to controlling the relative humidity in the room, the Barber-Colman Hygrostat also *indicates* the existing relative humidity by means of a small pointer at the top of the instrument, as shown in the illustration. The latter is a valuable feature not found in many hygrostats.

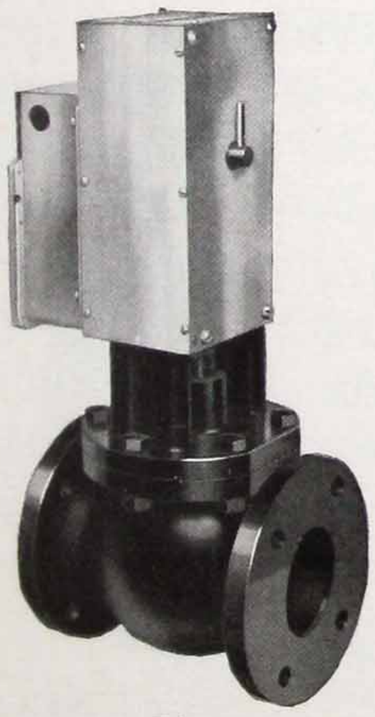
As with other units of the Barber-Colman Electric System of Temperature Control, the Hygrostat has a moulded phenolic resin base and cover and its operating parts are carefully designed, accurately assembled, and rust-proofed in order to give maximum life and dependable service.

MOTOR-OPERATED VALVES

BARBER-COLMAN Motor Operated Valves are available in three different types, namely, Packless Valves, Packed Valves and Line Valves. In all types the motive power for these motor-driven valves is the same—the Barber-Colman shaded pole induction motor which runs on low voltage alternating current. By means of a set of reduction gears this motor drives a camshaft on which is mounted a cam that imparts a positive longitudinal motion to a plunger sleeve. This sleeve, which is made as part of the cam follower, fits over the valve stem with a yielding connection including a spring which exerts a definite predetermined pressure on the valve disk when the valve is closed.



Packless Valve



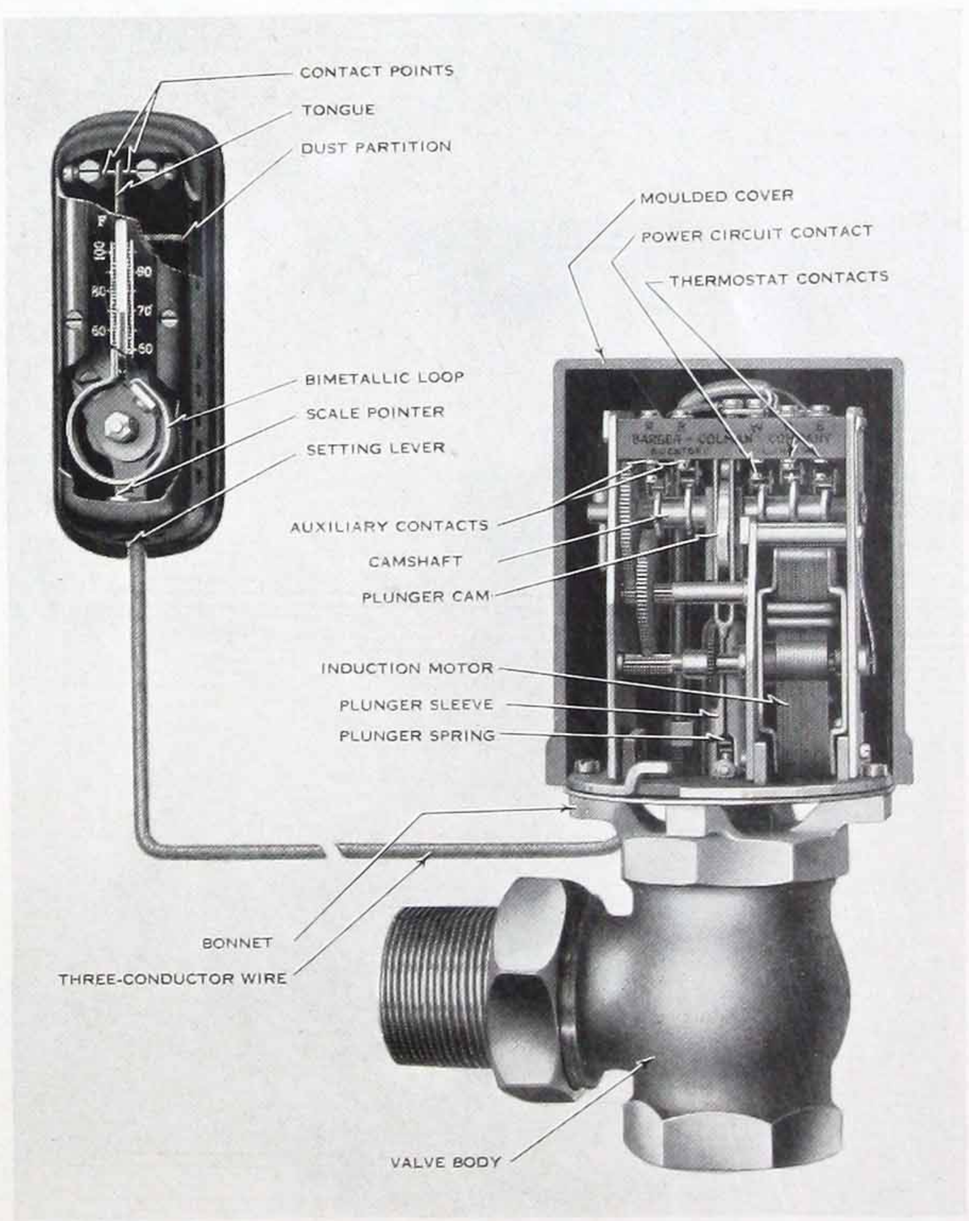
Line Valve

The camshaft also carries a cam which operates a switch to stop the motor when the valve is either fully open or completely closed. In this way, power is consumed only when the motor is actually doing the work of opening or closing the valves; if it were otherwise, the cost of power would become a serious factor. Positive stopping at the end of the stroke is essential on a gravity one-pipe steam system to prevent water hammer.

There are also two cams on the camshaft which control the auxiliary contacts that may be used for a relay to control other equipment. For instance, when more than one valve is controlled from a thermostat, only one of them is in operation at a time, as the signal is passed along from one to the next by means of the auxiliary contacts. In this way the electrical load on the thermostat is never more than the current for one motor-operator.

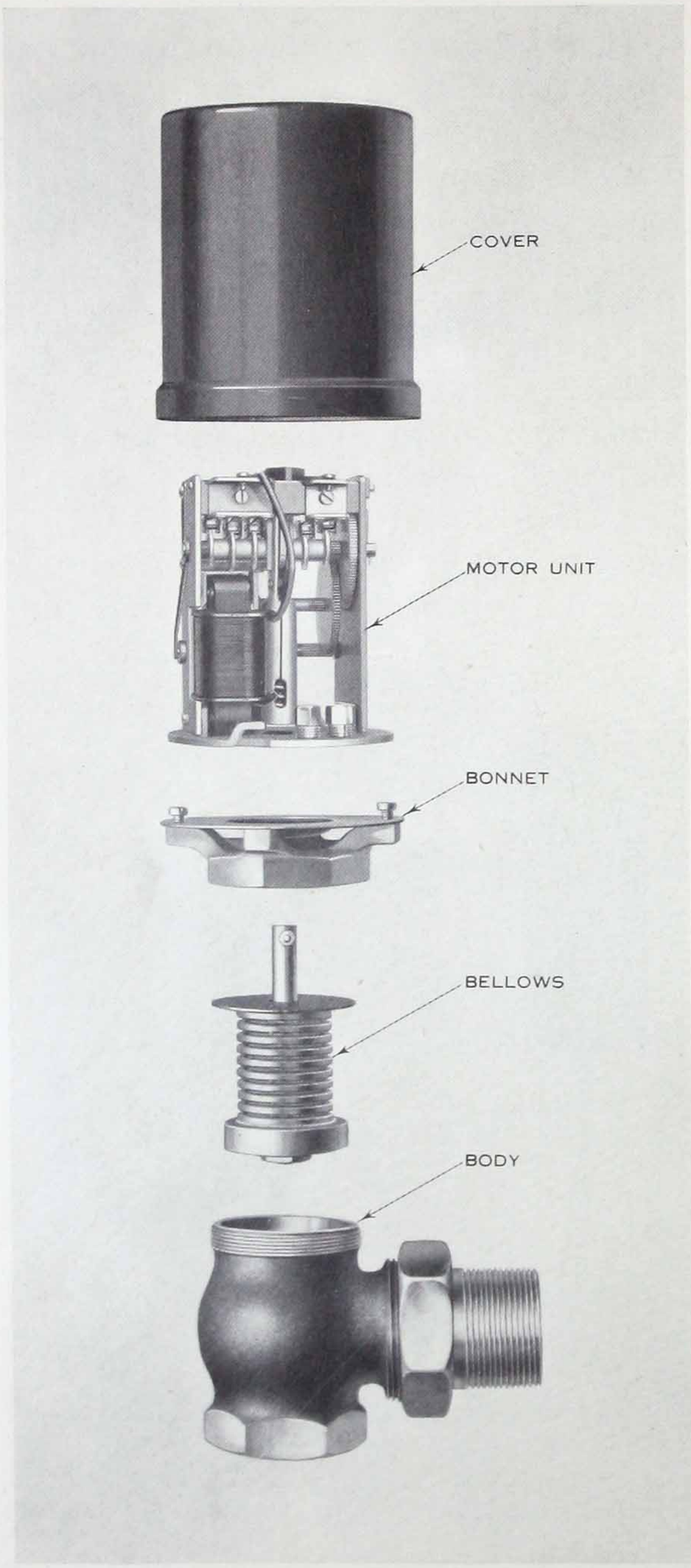


Packed Valve



Thermostat and Valve with Covers Cut Away to Show Parts

PACKLESS VALVES



Principal Parts of Packless Valve

THESE valves are generally used on steam radiators in direct radiation heating systems. They are made with nickel-plated brass bodies having polished trimmings. The complete assembly, as shown in the illustration, consists of the body, the bellows, the bonnet, the motor unit, and the cover. Metal bellows, or expansion members, make the valves "packless." The bonnet and motor unit are separable so that the valves may be installed without the motor-operators and may be manipulated with removable handwheels when so installed. This construction facilitates installations and allows a heating system to be tested before the complete control apparatus is attached. The danger of damaging motors during the construction of a building is also obviated. After taking off the temporary handwheels, the motor units and covers may be installed and locked on the bonnets and the necessary connections completed.



Packless Valve
Globe
Pattern



Packless Valve
Angle
Pattern



Packless Valve
Straightway
Pattern

Neat appearing covers of warp-proof moulded phenolic resin fully enclose the motor units. In certain types of installations a metal cover may be more desirable than the moulded one and these are available. An attachment

is available which will lock any of these covers in position after they are in place on the motor unit. This is a small spring-actuated catch which prevents the cover being removed unless a special wrench is used to release the catch. Also, a special metal cover embodying a mercury switch is available for certain types of work, generally with unit heaters. The use of this special cover is described on page 12.



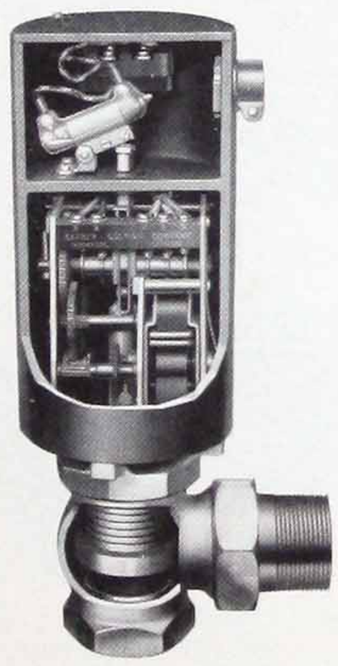
Packless Valve
R. H. Corner
Pattern



Packless Valve
L. H. Corner
Pattern

These valves can be used effectively on gas lines as well as steam, and in this case a special disk is supplied. Packless valves are designed for pressures not exceeding ten pounds per square inch, gauge.

Motors and motor-operators are substantially built and properly designed to give satisfactory service under the varying temperature conditions to which they are subjected.



Packless Valve
with Special Cover
Embodying
Mercury Switch.
Cut Away View

PACKED VALVES

BARBER-COLMAN Motor Operated Packed Valves are in general the same as the packless valves described above except that they are designed for use on steam or gas or water service with pressures higher than ten pounds per square inch, gauge. The pressure capacity of the Packed Valves for the various sizes will be found in the table below. These valves have the same motor-operators as the larger sizes of packless valves but the operators for the packed valves are geared so that the stroke is slower and consequently more powerful. A different type of bonnet is used embodying a packing gland of the conventional type. Three patterns are available in this valve as shown in the illustration. Construction throughout is of the best material in order to insure long life and dependable service.



Packed Valve
Angle Pattern
Screwed Ends



Packed Valve
Angle Pattern
Radiator Ends



Packed Valve
Globe Pattern
Screwed Ends

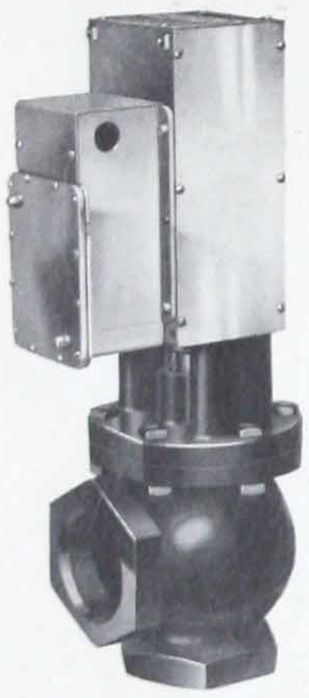
DIFFERENTIAL PRESSURE CAPACITIES OF PACKED VALVES

Static Pressure—125 lbs. per sq. in. gauge.

Size	½″	¾″	1″	1¼″	1½″	2″
Steam Tight	125	75	65	45	30	10
Water Tight	125	90	75	55	35	15

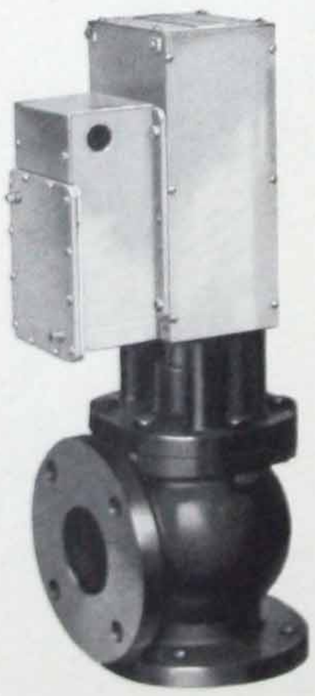
LINE VALVES

THESE valves are intended to be used on steam and water mains and other supply lines and are available in sizes from 2″ up to 8″ in the four patterns shown in the illustrations. Two types of this valve can be supplied, namely, Positive Acting or Reversing. The former is identical in action and principle to the packed type valve described previously. The reversing type may be stopped at any point in its travel by the action of the thermostat or caused to move in the opposite direction. Either of these types of valves may be actuated from a manual switch or other apparatus in place of a thermostat.



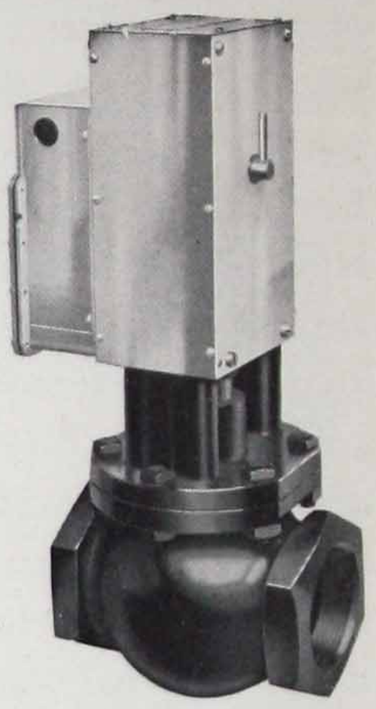
Line Valve
Angle Pattern
Screwed Ends

The motor is mounted in the small case at the side of the large case above the valve. This motor case is filled with oil and sealed so that the motor runs always in a bath of oil. The large case contains some of the reduction gears and the camshaft carrying the positive cam which operates the valve plunger, with the powerful springs which exert a definite pressure on the valve seat after the valve is closed.



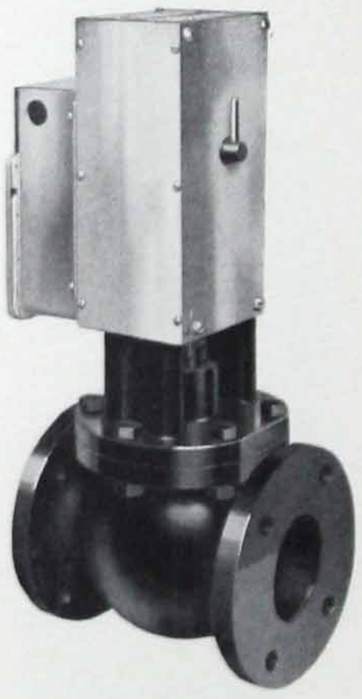
Line Valve
Angle Pattern
Flanged Ends

These valves are of the "packed" type, having a regular stuffing box around the plunger, and are designed for a maximum static pressure of 150 lbs. per square inch, gauge, and for a differential pressure in accordance with the table below. The 5″, 6″, and 8″ sizes of these line valves are available only in the "balanced" and "semi-balanced" types, and in the globe pattern only.



Line Valve
Globe Pattern
Screwed Ends

These valves have a cast iron body. The valve seat is bronze and the valve disk of composition.



Line Valve
Globe Pattern
Flanged Ends

One illustration of the use of line valves may be found in the picture on page 40, showing their installation on the coils of a ventilating system. They are also useful for controlling central heating station steam, the main risers of a zone control system and many other purposes.

DIFFERENTIAL PRESSURE CAPACITIES OF LINE VALVES

Static Pressure—150 lbs. per sq. in. gauge.

Nominal Size	2″	2½″	3″	3½″	4″
Tight	40	30	20	15	10
Throttling Service	60	40	30	20	15

DAMPER CONTROLLERS

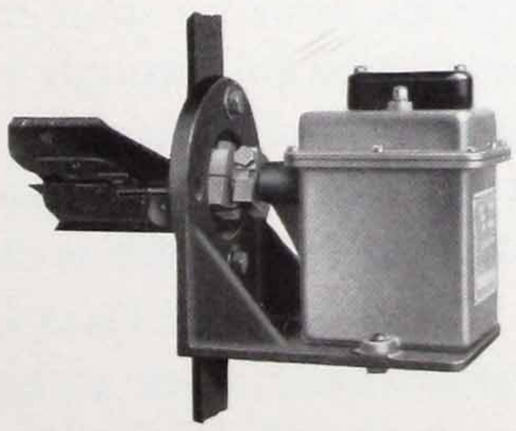
THE Barber-Colman Damper Controller is a unit which may be used on a great many different types and sizes of dampers as shown by the accompanying illustrations. It is available in several models, each of which have special characteristics that suit it for the work to be performed. The units are well designed, strongly built, thoroughly tested and guaranteed for satisfactory operation.



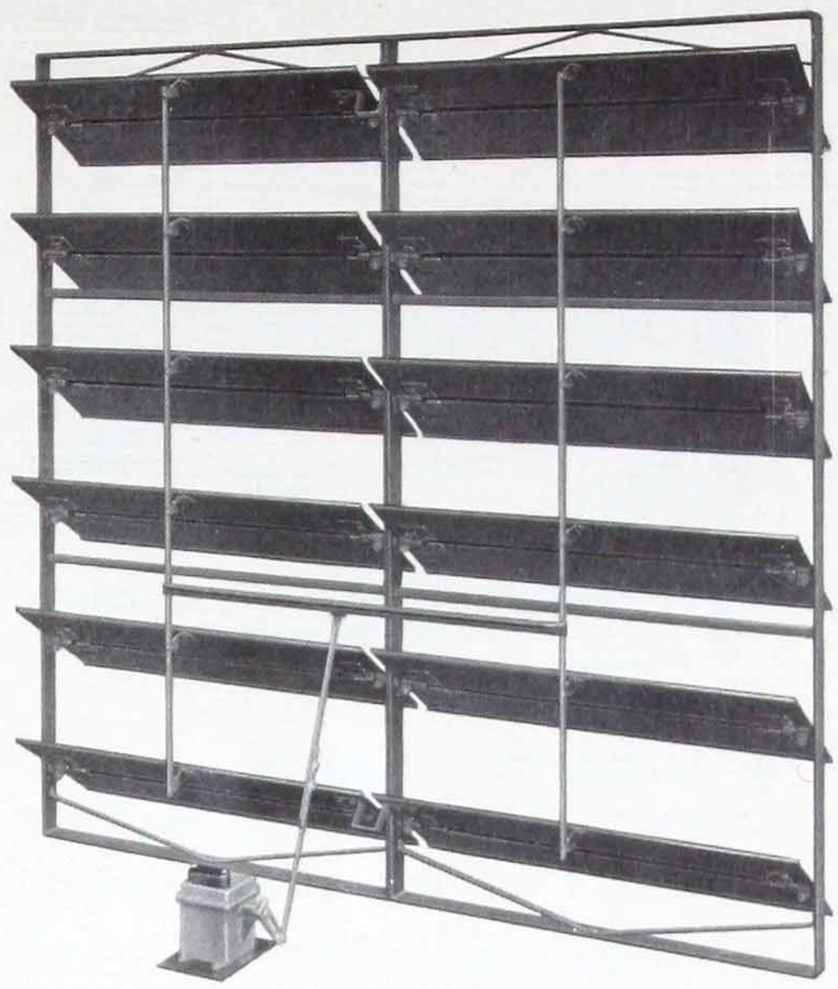
Damper Controller

The Barber-Colman Damper Controller consists essentially of the same low voltage shading ring induction motor used in other units of the Barber-Colman Electric System of Temperature Control. This motor is mounted in a die-cast metal case and drives, by means of a set of reduction gears, a shaft which protrudes from the case. The case is filled with a light oil and sealed at all points so that all moving parts run in a bath of oil, thus insuring long life and quiet, dependable operation.

In this unit, the same as in the valve motor-operator, there is a camshaft driven by the motor which opens and closes various contacts as the shaft is revolved. The positive type has a running circuit contact



Damper Controller Direct Connected to Damper



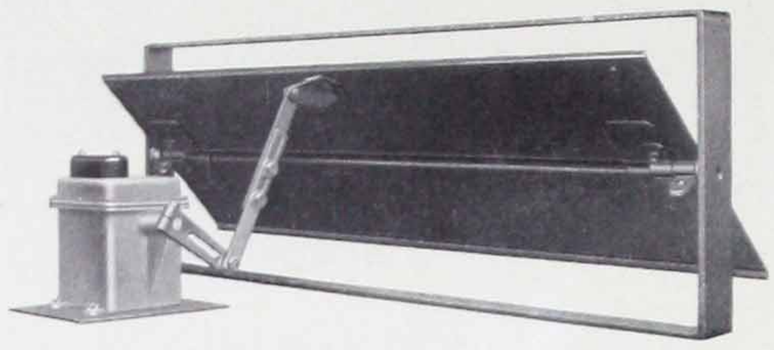
Single Damper Controller Connected by Linkage to Multi-Louvred Damper

which relieves the thermostat of the necessity of breaking the operating current. The reversing type of controller has its two sets of shading coils connected in series with the thermostat contact points and with limit switches on the camshaft of the operator.

There are also several auxiliary contacts in the Damper Controller which may be used as switches for the control of other units of the equipment. For instance, in Blast Systems, as shown on page 19, it will be noticed that the position of the by-pass damper preceding the fan controls the action of the line valve on the steam coils above it. This operation is performed by these auxiliary contacts.

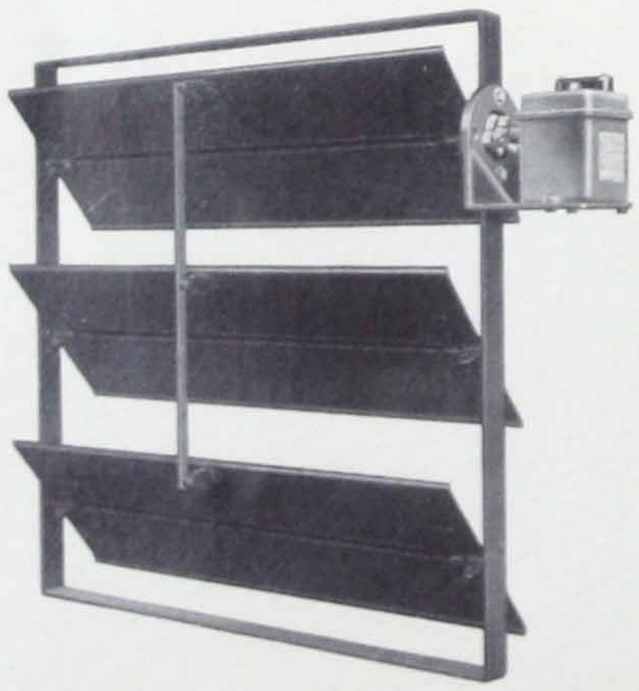
Damper Controllers are available in two sizes, Type aYCg and Type eYCc. The

Type aYCg Damper Controller is supplied in either the Positive or Reversing type and is generally used in unit ventilators and other locations where space is limited,



Damper Controller Connected by Linkage to Single Leaf Damper

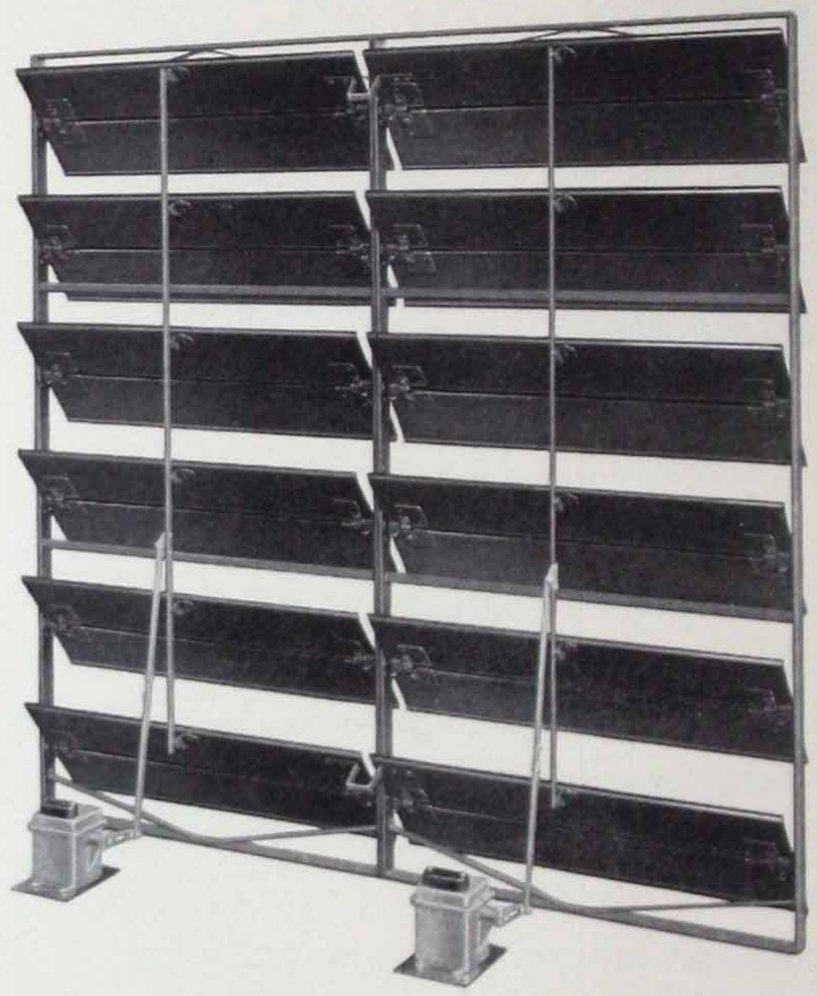
and the performance required does not exceed the lower capacity of this smaller unit. The Type eYCc size is available in Positive or Reversing and other special types and is the one most generally used in all applications of damper controlling equipment.



Damper Controller Direct Connected to One Leaf of Linkage Connected Three Leaf Damper

The special types mentioned include Controllers made to be governed by manual position switches which will cause the controller to move the damper to a definite point and hold it there until governed otherwise by a change of the switch.

The Positive type of these Damper Controllers uses the regular shading ring induction motor and is so arranged that the shaft will be turned through a fixed angle, generally 180°, this being determined when the



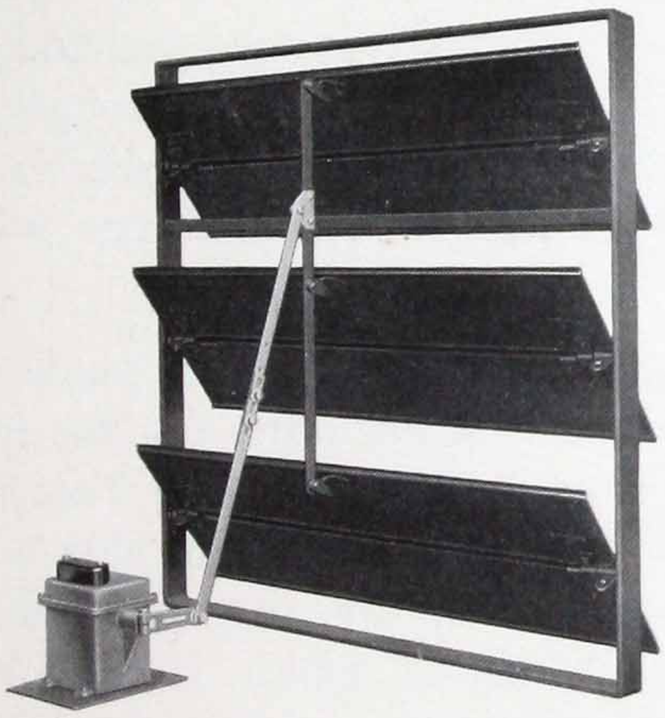
Two Damper Controllers Connected by Linkage to Multi-Louvred Intake Damper

controller is assembled. The Positive Controller turns its shaft in one direction only and will go through part of a revolution when one controlling switch is closed, completing the revolution when the other controlling switch is closed.

The Reversing Damper Controller, on the other hand, uses a shading *coil* induction motor in which the flow of current through the shading coils may be changed by the thermostat or other means, thus reversing

the direction of rotation of the motor. Cam operated switches limit the rotation of the shaft as desired, this usually being 90° or 180°. By reason of the reversing construction, the direction of the rotation of the shaft may be reversed at any position between these two limiting positions, or it may be stopped completely, as determined by the thermostat or other switch.

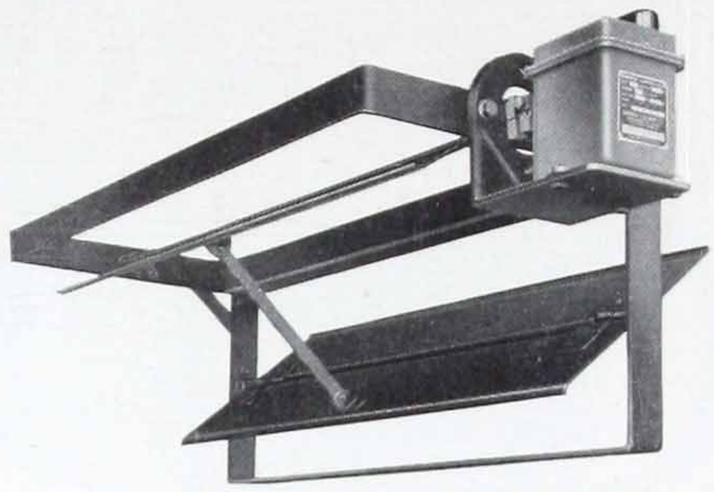
Speed variation in the various types of Damper Controllers is accomplished by one of two means. In the Fixed Speed model a fixed governor is built into the unit. The speed of rotation is fixed when the unit is



Damper Controller Linkage Connected to Three Leaf Damper

built and cannot be changed. The Adjustable Speed model has a governor built into it which is adjustable from the outside of the case and will give a speed range of ten to one.

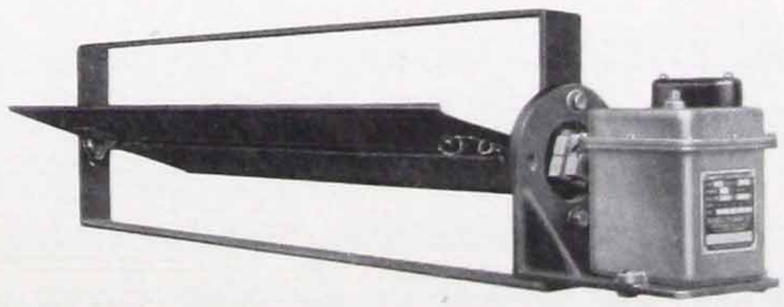
As can be seen from the accompanying illustrations of installations, these damper controllers can be used for a wide variety of work on both single or multi-louvred dampers. They may be mounted in any position and are capable of being used in any type of heating or ventilating system which requires the control of dampers.



Damper Controller Direct Connected to Mixing Damper

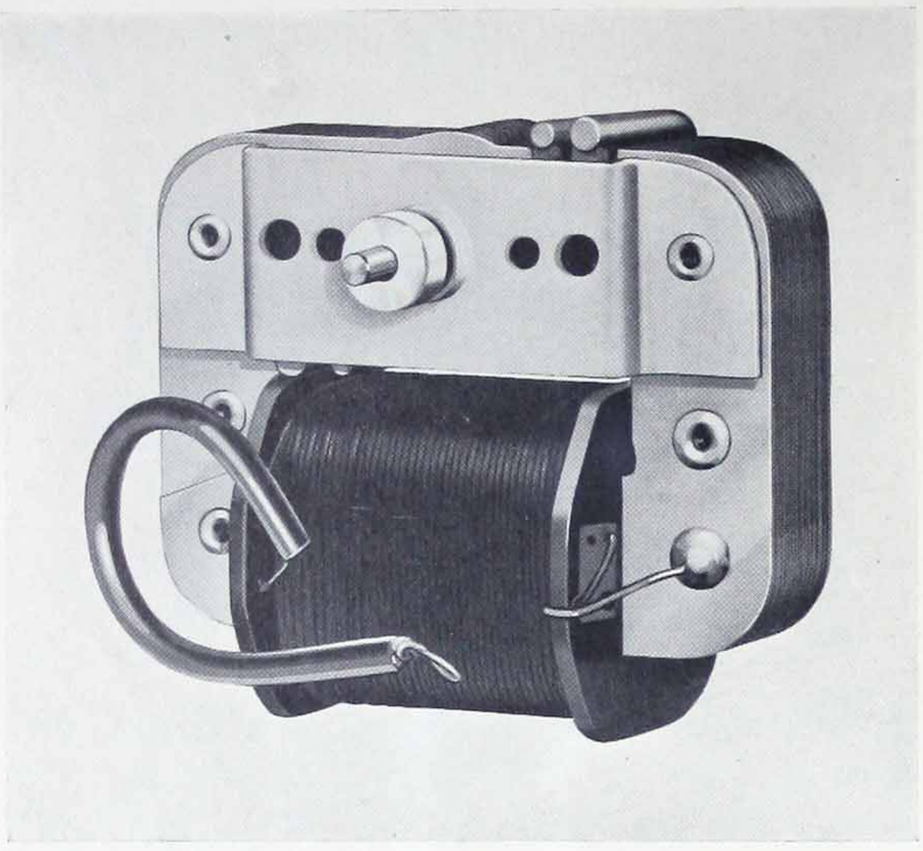
The Type eYCc Damper Controller, being the larger of the two sizes of this unit, will handle louvre-type dampers up to approximately 50 sq. ft. in area. The Type aYCg, which is smaller and has a lower torque rating, will take care of dampers up to approximately 15 sq. ft. in area.

All necessary accessories are available for use with this equipment. These include lever arms, coupling fittings, mounting brackets, and multi-position switches. The use of most of these pieces is shown in the accompanying illustrations.



Damper Controller Direct Connected to Single Leaf Damper

MOTORS



Barber-Colman Shading Ring
Induction Motor

THE principal thing which prevented the successful development of an electric system of temperature control previous to the advent of the Barber-Colman system, was the lack of a suitable motor. The motor developed by Barber-Colman Company for use in this system has all the necessary requirements—small size, ample power, quiet operation, dependability, advantageous current characteristics, reasonably good efficiency, and low manufacturing cost.

The principal feature of the Barber-Colman Motor is the fact that it is a shading-ring induction motor with squirrel-cage rotor, thus eliminating the necessity for brushes, commutators or slip rings, and producing a unit consisting of only two principal parts. These parts are, first, the Stator, which is a riveted unit and includes the coil, the field laminations, the shading rings and the shaft bearing supports; second, the Rotor, which consists of the armature laminations solidly mounted on the motor shaft. The assembly is extremely simple and rugged throughout and the parts are accurately made and carefully put together to insure long life and dependable operation.

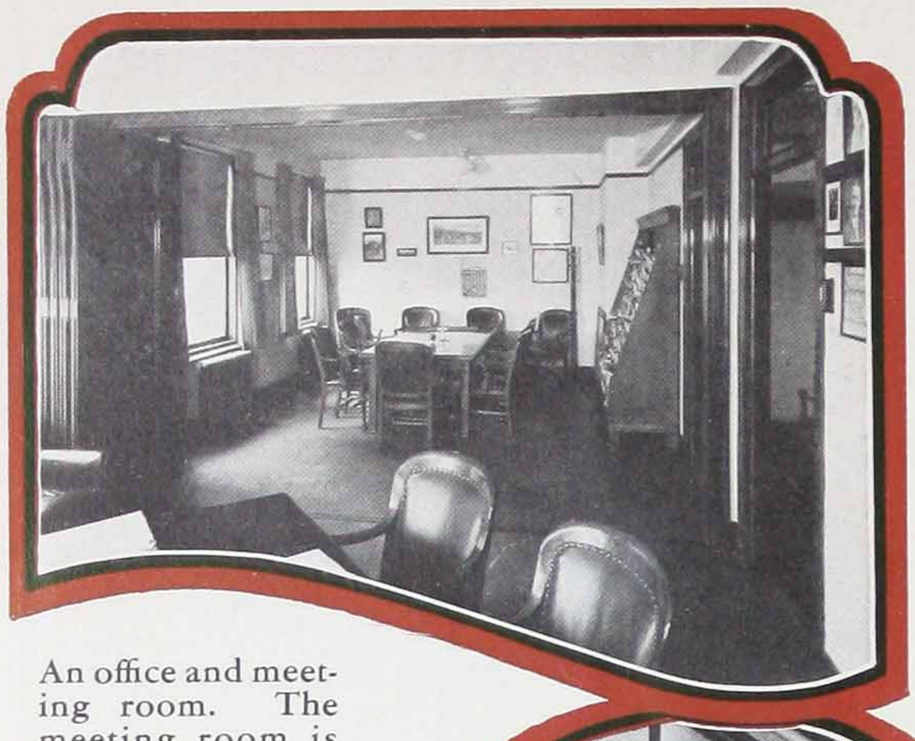
Holes through the field laminations may be provided for mounting or the motor may be mounted in trunnions on the shaft bearing cases. The shaft is hardened and ground to close limits and pressed through the assembled rotor, the surface of which is then ground to proper size and true with the shaft.

Barber-Colman Motors are made up and supplied as separate units for use in other types of mechanisms than the Temperature Control System described in this bulletin. Quantity production methods and high quality standards make it possible for Barber-Colman Company to offer this small and very useful fractional horsepower motor at low cost.

This motor may be built and wound for different voltages and different frequencies within a range of 10 to 220 volts and 25 to 60 cycles. It can be used only on alternating current.

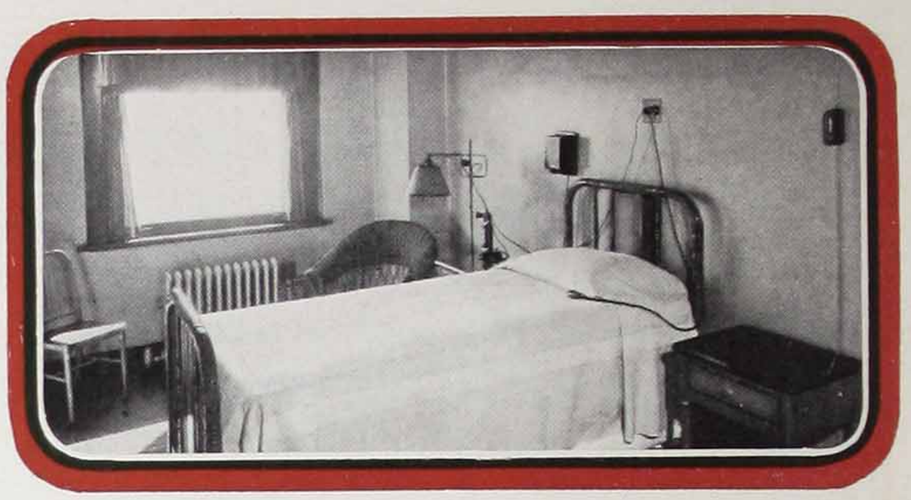
The Engineering Department will advise any inquirer concerning making up these motors in either standard or special windings.

INSTALLATION VIEWS *and* DIMENSIONS *of* UNITS

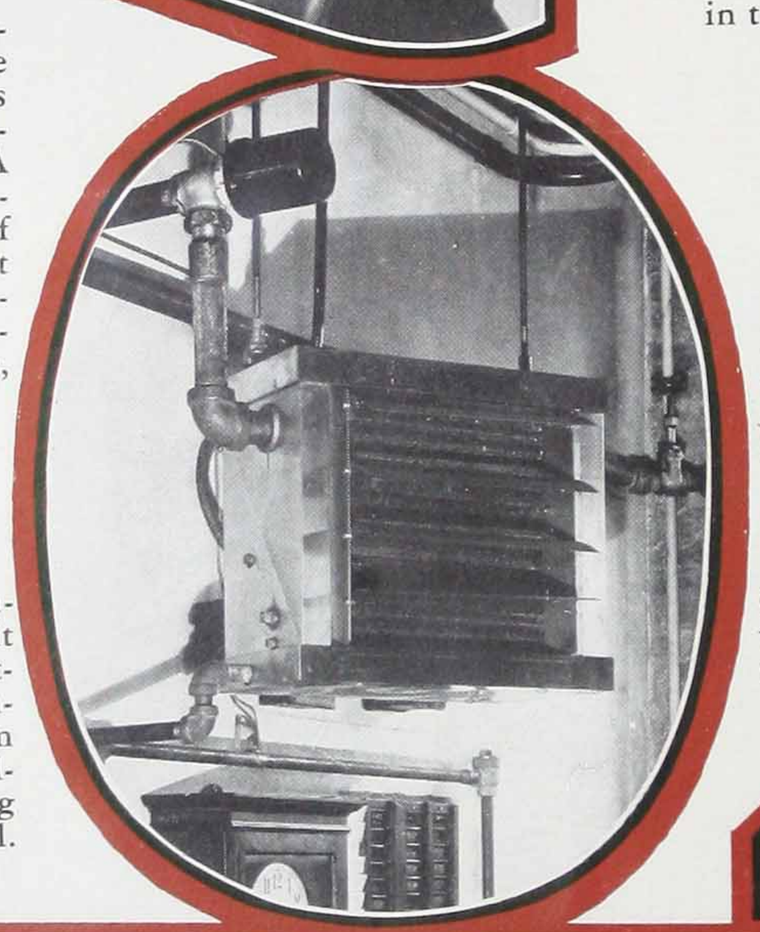


An office and meeting room. The meeting room is divided by a folding partition. A thermostat is located in each half of the room. Part of a suite installation. Western Society of Engineers, Chicago, Ill.

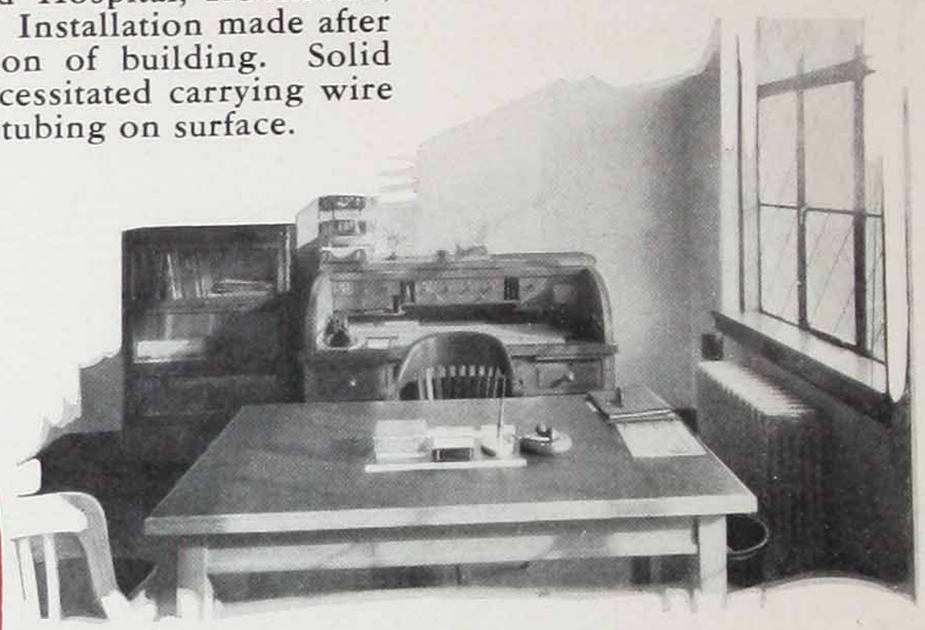
BARCOL



Rockford Hospital, Rockford, Illinois. Installation made after completion of building. Solid walls necessitated carrying wire in tubing on surface.



An industrial installation on a unit heater in a printing plant for control of press room temperature. Wilson-Hall Printing Co., Rockford, Ill.



Control of direct radiation in an office. Thermostat on wall not shown. Building uses central heating plant steam. Wilson-Hall Printing Company, Rockford, Ill.



Rockford National Bank Building, Rockford, Illinois. Control is on direct radiation in banking room (where radiation is concealed) and in offices throughout building.



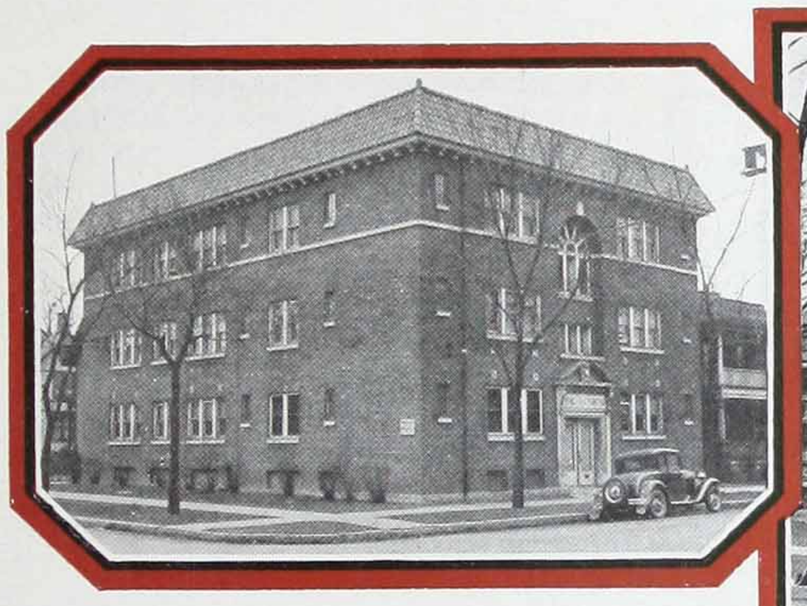
An office installation with direct radiation concealed under windows. Thermostats on wall and posts for sections of office. Otis Elevator Company, Chicago, Illinois.



Valencia Court Apartments, Rockford, Illinois. Individual room control of direct radiation throughout four buildings.



A residence in Rockford, Ill., having individual room control of direct radiation with relay control of oil burner

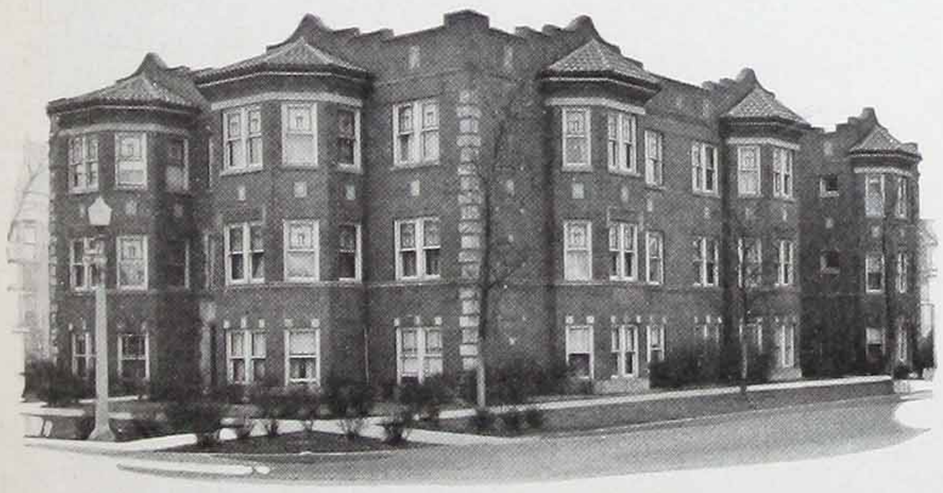


Kathryn Apartments, Rockford, Illinois. Individual room control of direct radiation throughout.



Highland Court and Highland Manor Apartments, Rockford, Illinois. Individual room control of direct radiation throughout.

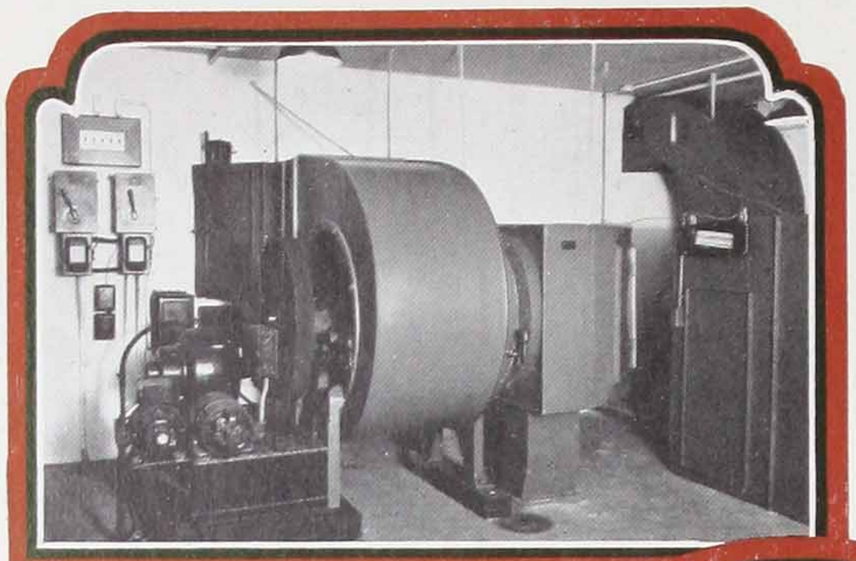
BARCOL



Clarence Apartments, Berwyn, Illinois. Individual room control of direct radiation throughout.



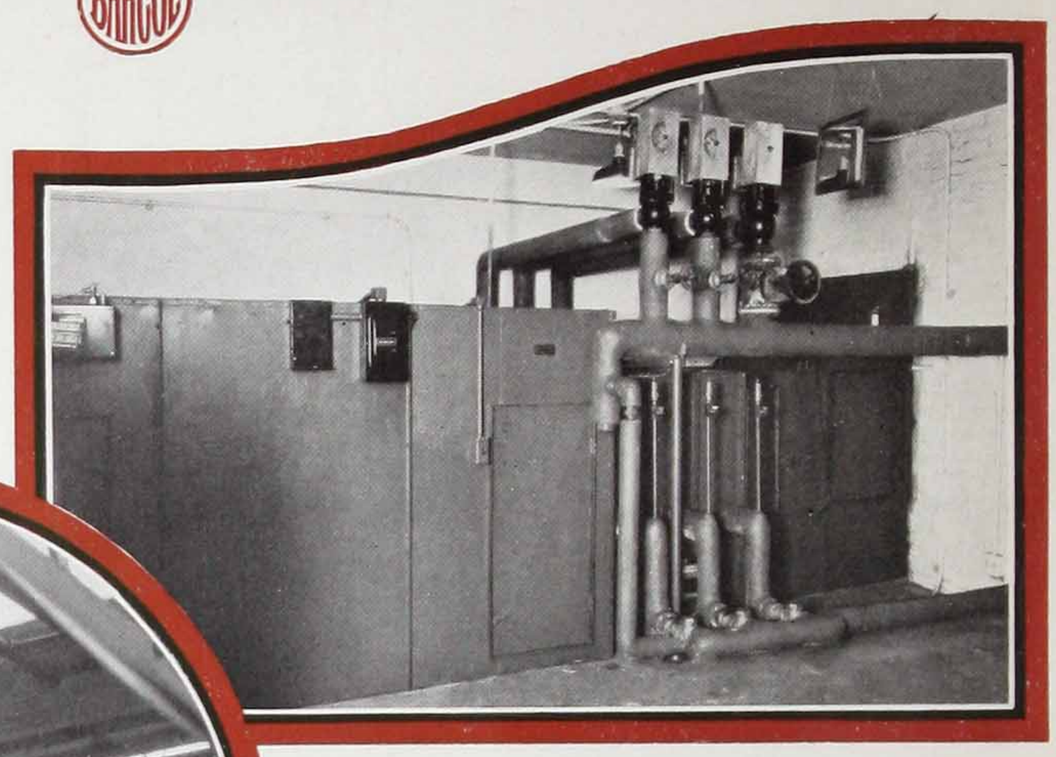
A residence in Rockford, Illinois having individual control of direct radiation with relay control of oil burner.



Ventilating system at Otis Elevator Company, Chicago.



Atwood Vacuum Machine Company, Rockford, Ill. Packless valves on supply lines to ceiling steam coils.



Ventilating system at Otis Elevator Company, Chicago, Illinois. Tempered air duct with line valves on steam coils. By-pass damper controller visible between pipes at bottom of duct.



Above, an industrial application in the shop of Greenlee Bros. & Co., Rockford, Ill., with packless valves on feeders to wall and ceiling steam coils.



Above, a unit ventilator in a drafting room with control of fan only by a thermostat on opposite wall. Greenlee Bros. & Company, Rockford, Ill.



Left, a unit heater in the D. J. Stewart & Company Parking Garage, Rockford, Ill. A thermostat on a post out in the center of the floor controls the heater by means of a relay.



Central Illinois Public Service Building, Springfield, Ill. Individual room control throughout, with two-temperature thermostats. Ventilating system in basements and first floor also controlled. Architect: Law, Law & Potter, Madison, Wis. Heating Contractor: P. H. Meyer Co., Louisville, Ky.



Rockford Hospital, Rockford, Ill. Individual room control in all but old section. View in one room shown on page 38.



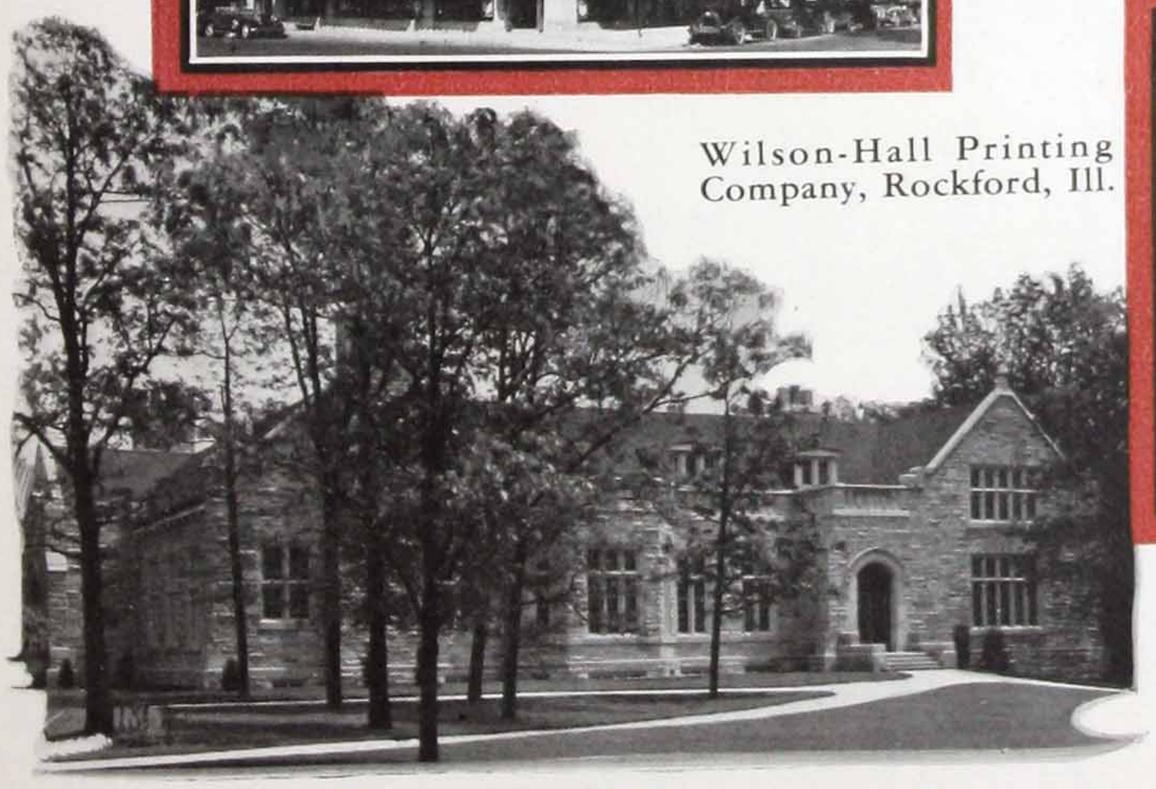
Downtown store building with control of direct radiation throughout. Rockford, Ill.





Wilson-Hall Printing Company, Rockford, Ill.

D. J. Stewart & Co. Parking Garage, Rockford, Ill. Automatic relay control of unit heaters. See interior view on page 40.

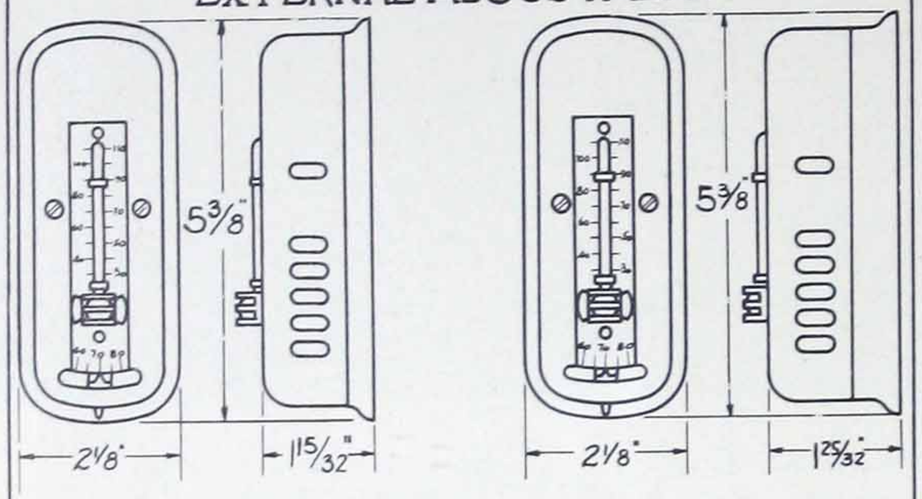


Highland Park Library, Highland Park, Illinois. A modern library building with control of all unit ventilators. Architect: Holmes and Flynn, 8 So. Dearborn St., Chicago, Ill. Heating Contractor: Murphy & Schwall, Highland Park, Ill.

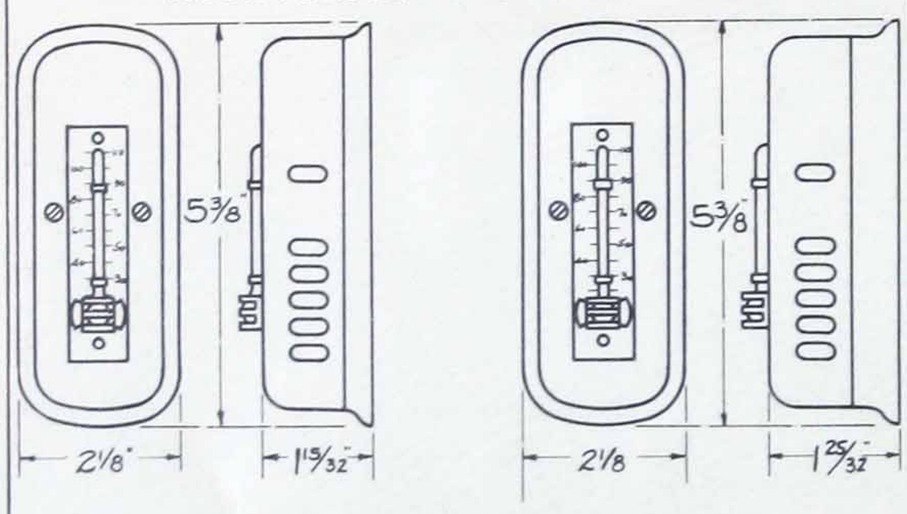
ROOM THERMOSTATS

STANDARD COMPOUND

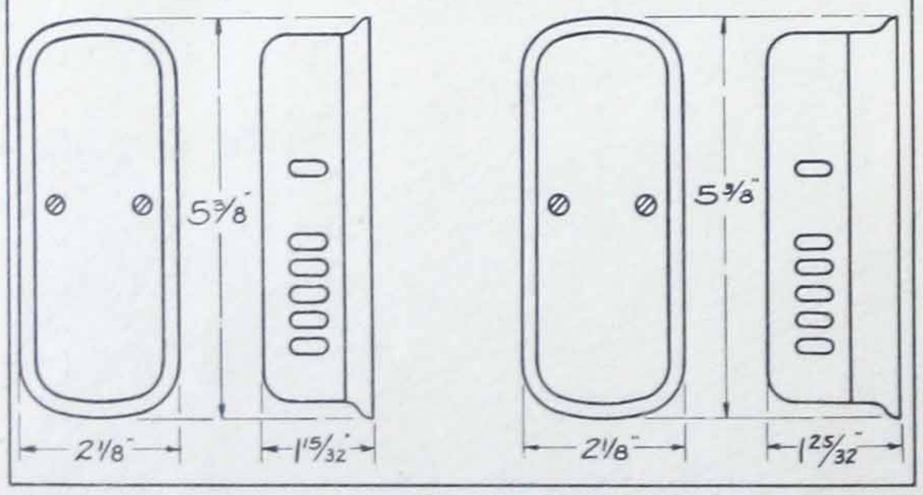
THERMOMETER EXTERNAL ADJUSTMENT



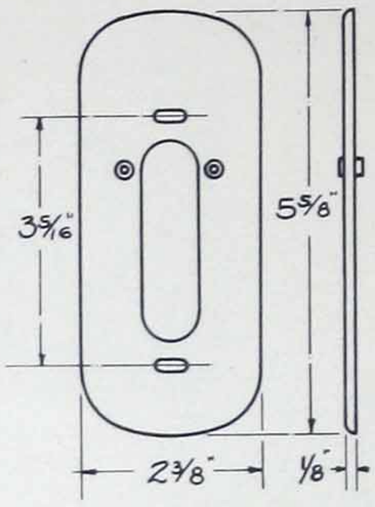
THERMOMETER INTERNAL ADJUSTMENT



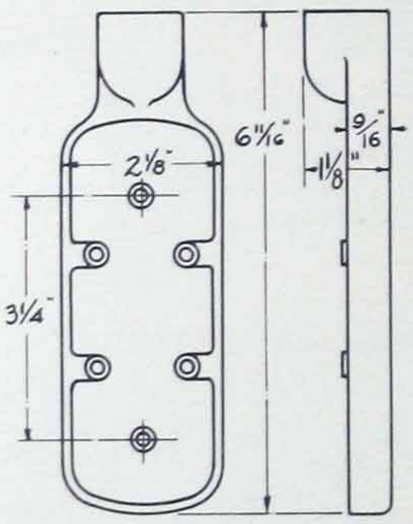
NO THERMOMETER INTERNAL ADJUSTMENT



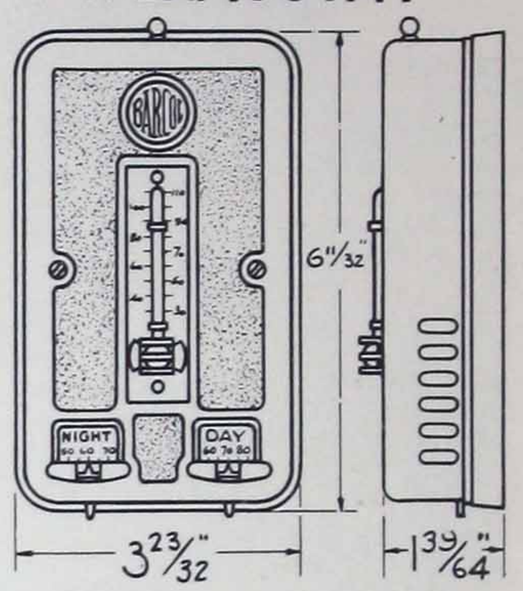
THERMOSTAT PLATE



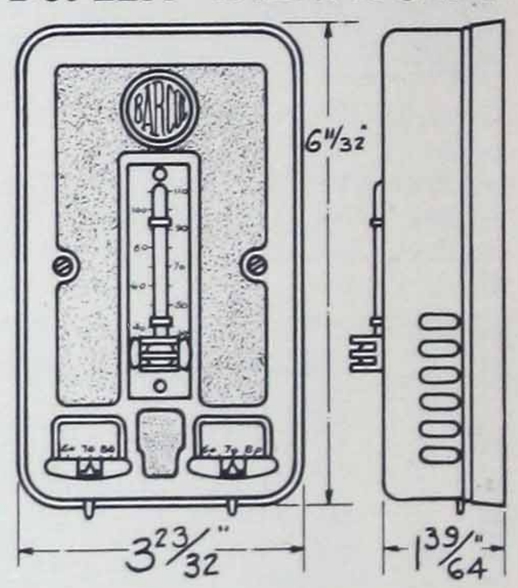
CONDULET



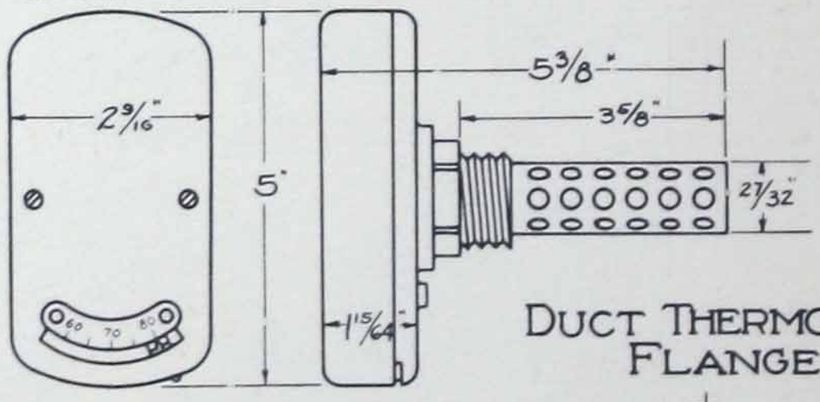
TWO TEMPERATURE THERMOSTAT



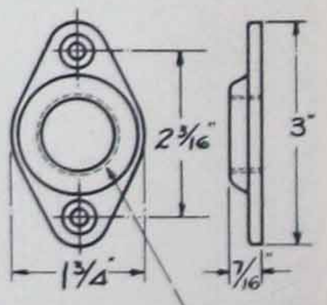
DUPLEX THERMOSTAT



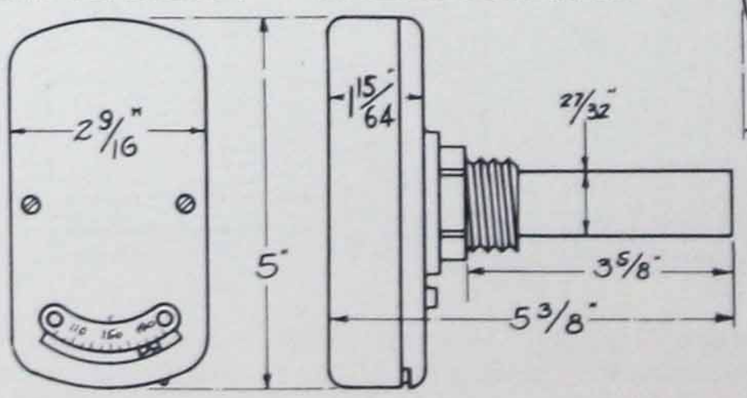
INSERTION THERMOSTAT



DUCT THERMOSTAT FLANGE



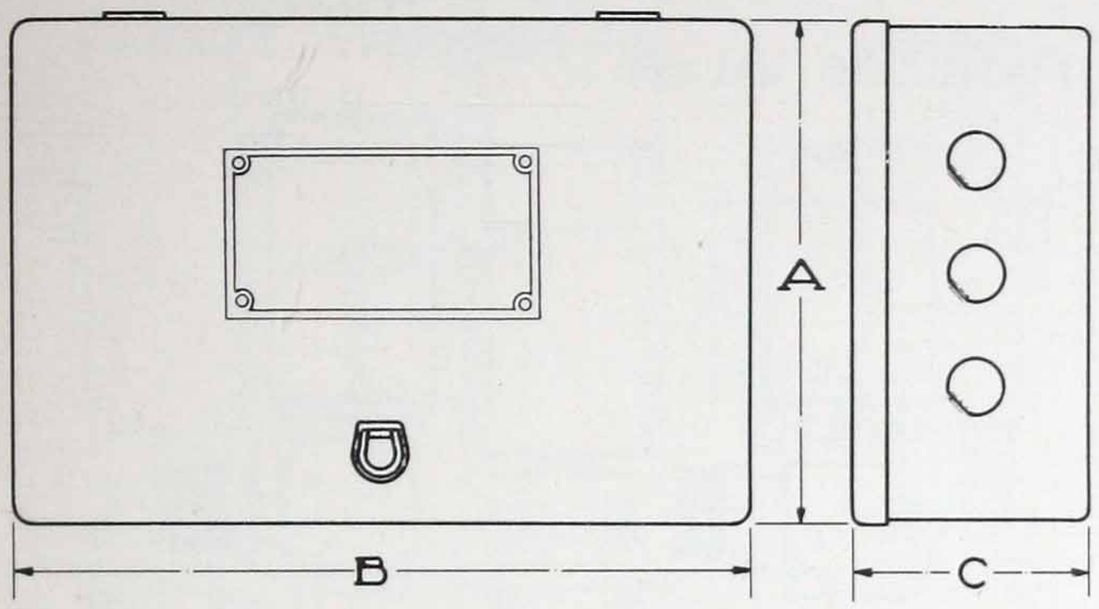
IMMERSION THERMOSTAT



DIMENSIONS OF UNITS

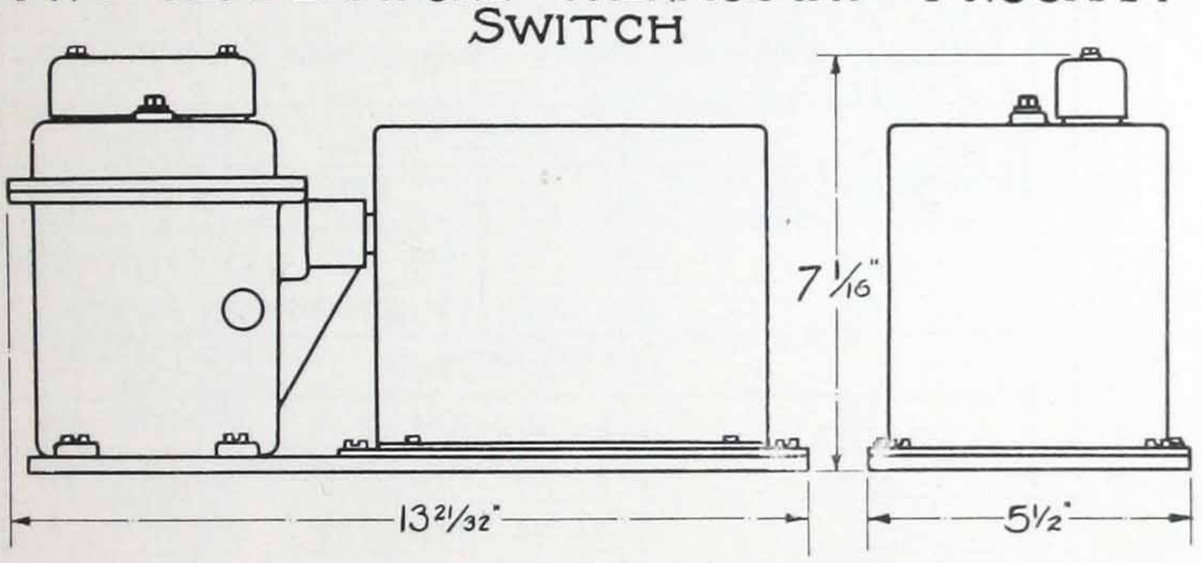
ROOM THERMOSTATS
TWO-TEMPERATURE THERMOSTAT
DUPLEX THERMOSTAT
INSERTION AND IMMERSION THERMOSTATS
THERMOSTAT PLATE CONDULET
DUCT THERMOSTAT FLANGE

POWER BOXES

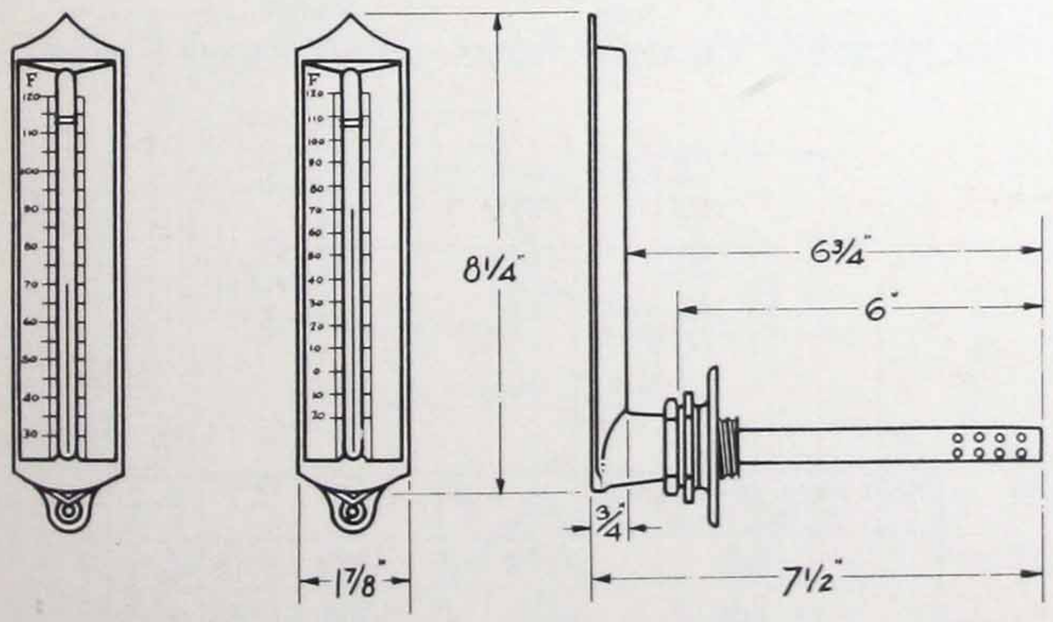


BOX STYLES	A	B	C
50 VA 110 VOLTS 220 VOLTS	6½	10½	4
125 VA 110 VOLTS 220 VOLTS	8½	12½	4
150 VA 110 VOLTS 220 VOLTS	8½	10½	5⅛
250 VA 110 VOLTS 220 VOLTS	10½	12½	5⅛

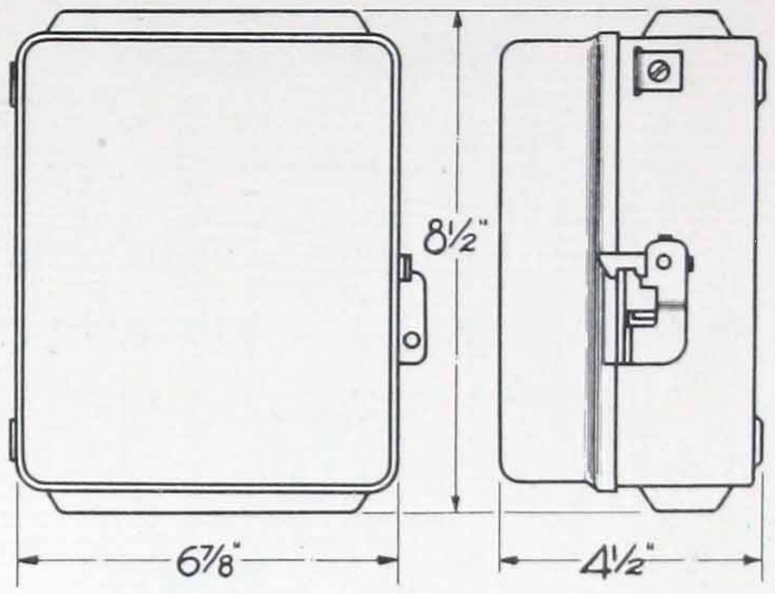
TWO TEMPERATURE THERMOSTAT PROGRAM SWITCH



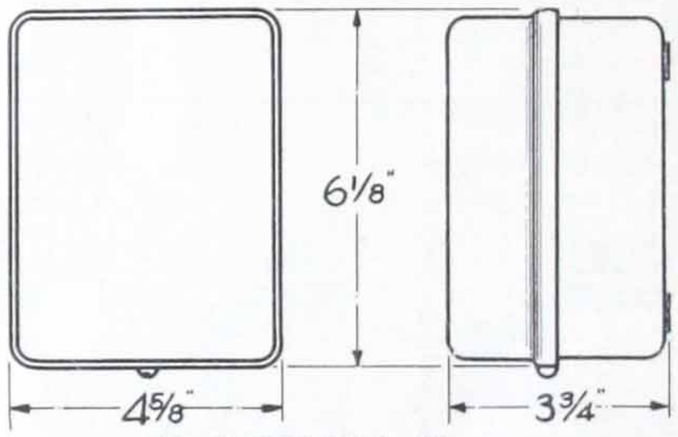
ANGLE THERMOMETERS



RELAYS



NORMALLY OPEN 3 POLE MAGNETIC SWITCH FOR 25 VOLT 60 CYCLE CIRCUITS



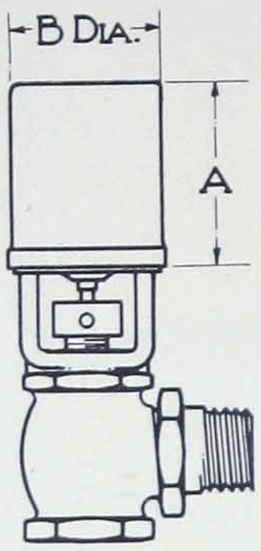
MODELS

UP AND DOWN SINGLE POLE 25 VOLT 60 CYCLE RELAY
UP AND DOWN SINGLE POLE 115 VOLT 60 CYCLE RELAY
UP AND DOWN SINGLE POLE 230 VOLT 60 CYCLE RELAY
NORMALLY OPEN DOUBLE POLE 25 VOLT 60 CYCLE RELAY
NORMALLY OPEN SINGLE POLE 25 VOLT 60 CYCLE RELAY
NORMALLY OPEN DOUBLE POLE 25 VOLT 60 CYCLE THREE WIRE CONTROL RELAY

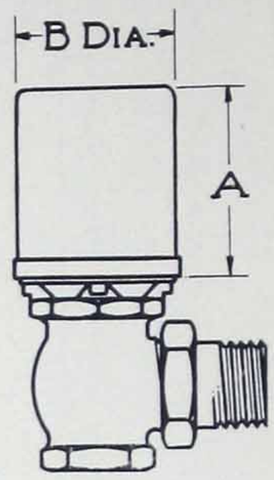
DIMENSIONS OF UNITS

POWER BOXES
RELAYS
PROGRAM SWITCH
ANGLE THERMOMETERS

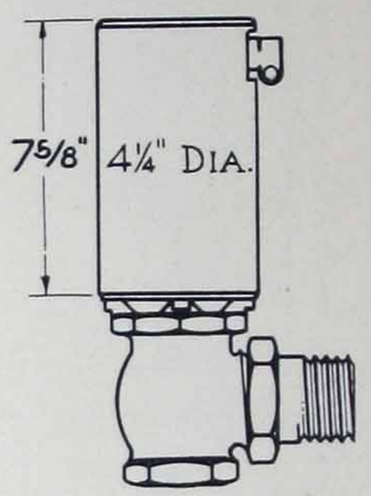
PACKED VALVE

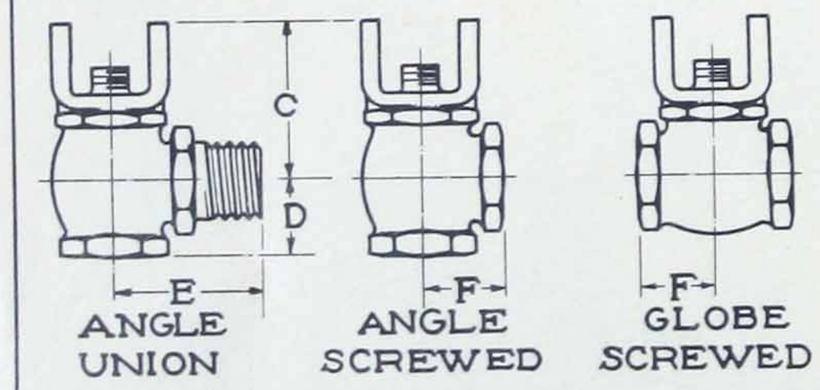


PACKLESS VALVE

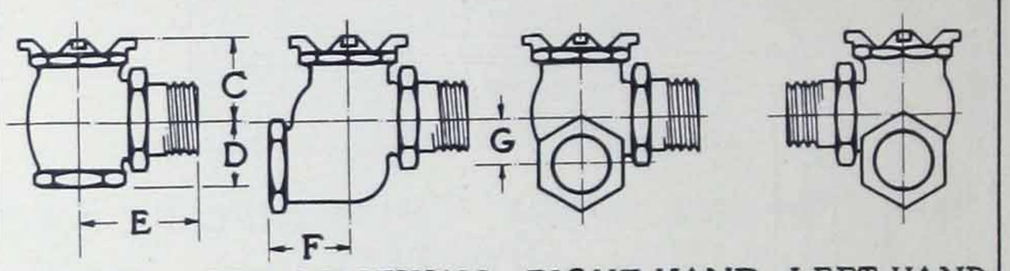


PACKLESS VALVE WITH MERCURY TUBE



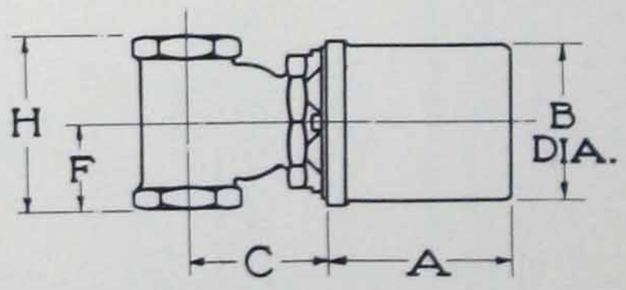


DIMENSIONS (STANDARD MOTOR)						
NOM. SIZE OF VALVE IN INCHES	A	B	C	D	E	F
½	4⅞	4	3 15/16	1 5/16	2 13/32	1 5/16
¾	4⅞	4	4 5/64	1 19/32	2 23/32	1 19/32
1	4⅞	4	4⅜	1⅞	3	1⅞
1¼	4⅞	4	4 35/64	2⅛	3 3/32	2⅛
1½	4⅞	4	4 51/64	2⅜	3¾	2⅜
2	4⅞	4	5 9/32	2⅞	4 25/32	2⅞



DIMENSIONS (SMALL MOTOR)							
NOM. SIZE OF VALVE IN INCHES	A	B	C	D	E	F	G
½	4⅜	3⅜	1⅝	1⅛	3	1⅜	⅝
¾	4⅜	3⅜	1 11/16	1¼	2⅞	1⅝	¾
DIMENSIONS (STANDARD MOTOR)							
½	4⅞	4	1⅝	1⅛	3	1⅜	⅝
¾	4⅞	4	1 11/16	1¼	2⅞	1⅝	¾
1	4⅞	4	1 13/16	1½	3	1⅞	1
1¼	4⅞	4	2	1⅝	3½	2 1/16	1⅛
1½	4⅞	4	2⅜	1⅞	3¾	2 5/16	1¼
2	4⅞	4	2 13/16	2¼	4⅜	2 1/16	1½

PACKLESS GLOBE VALVE (SCREWED ENDS)



NOM. SIZE OF VALVE IN INCHES	A	B	C	F	H
1¼	4⅞	4	3⅛	2 1/16	4⅛
1½	4⅞	4	3⅝	2 5/16	4⅝

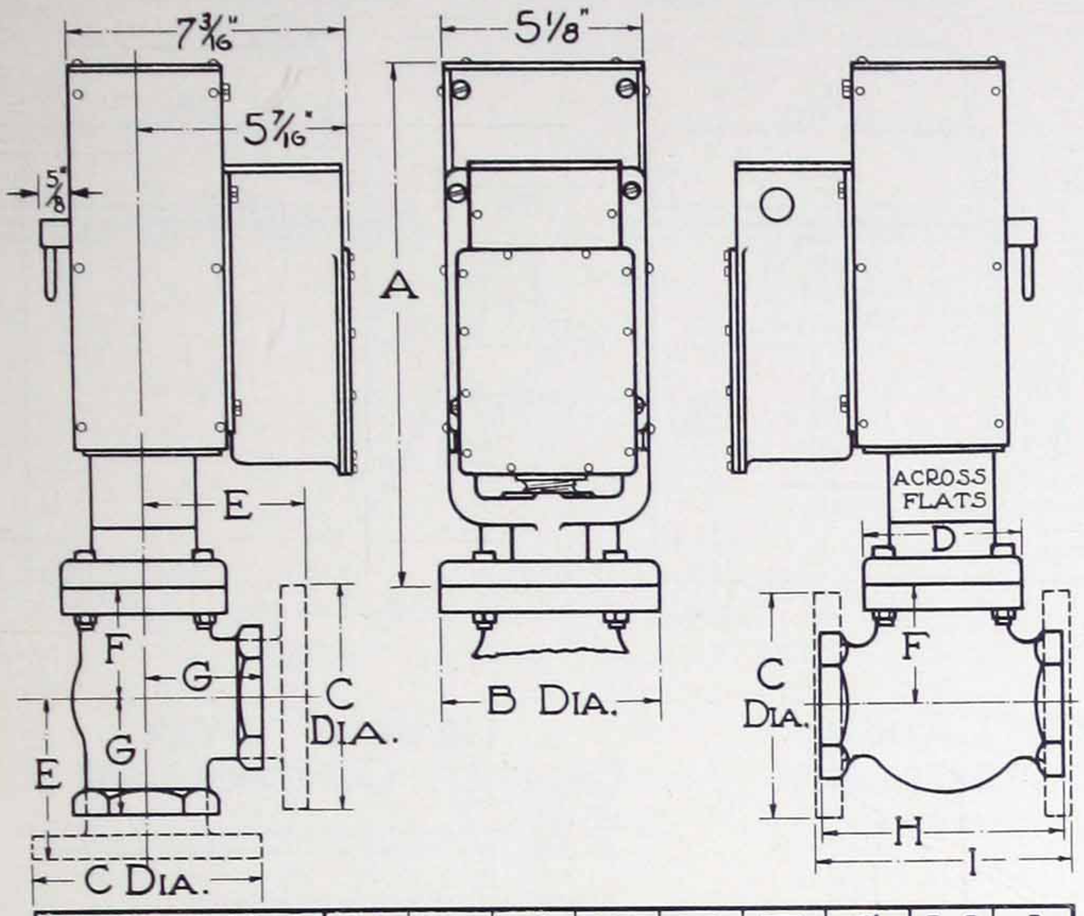
DIMENSIONS OF UNITS

PACKLESS VALVES

PACKLESS VALVES WITH MERCURY SWITCH

PACKED VALVES

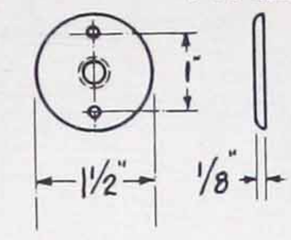
STEAM LINE VALVE

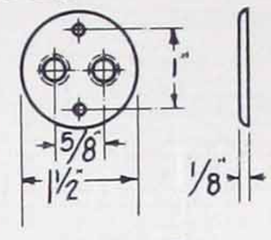


NOM. SIZE OF VALVE IN INCHES	A	B	C	D	E	F	G	H	I
2	13 1/4	5 5/8	6	4 1/16	4 1/8	3	3	6	6 1/2
2 1/2	13 1/2	6 1/8	7	5	4 5/8	3 1/8	4 1/4	7 1/8	8
3	13 1/2	6 7/8	7 1/2	6 1/4	4 1/4	3 1/2	4 1/8	8 1/8	8 1/2
3 1/2	12 15/16	7 1/2	8 1/2	6 1/2	5 1/16	4 1/8	4 1/2	9 1/8	10 1/8
4	12 13/16	8	9	7 1/8	5 1/2	4 3/8	5 1/4	10 3/8	10 3/4

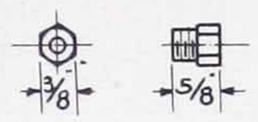
FITTINGS FOR MOUNTING BRASS TUBING

WALL PLATES

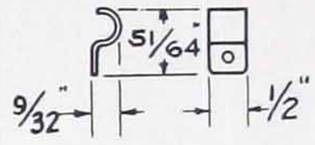




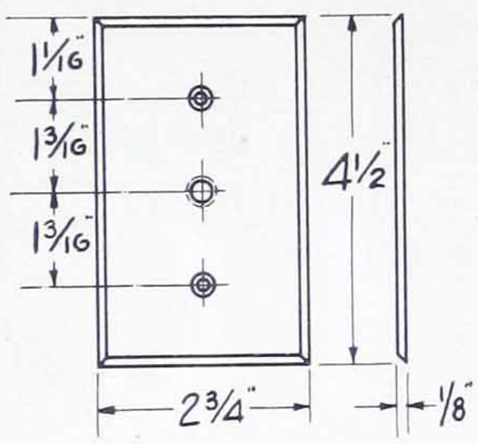
TUBING BUSHING

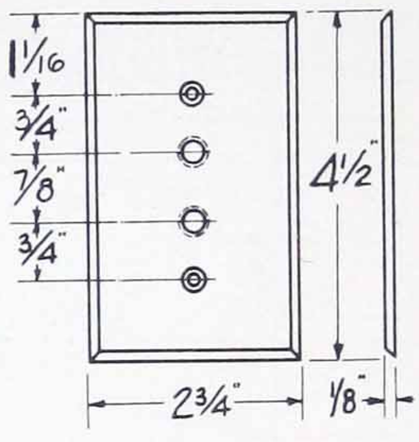


TUBING CLAMP

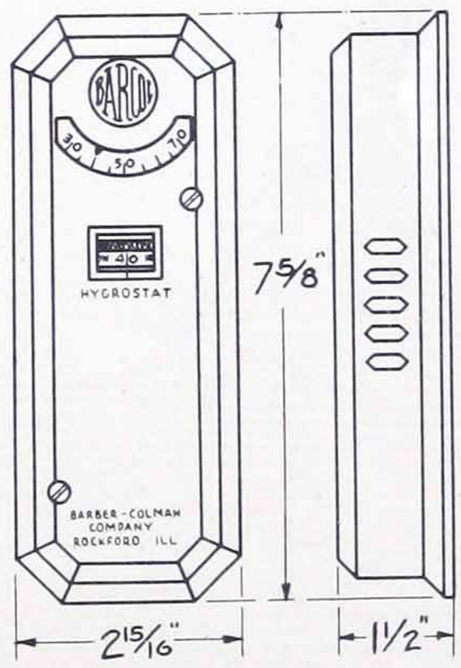


FLUSH PLATES

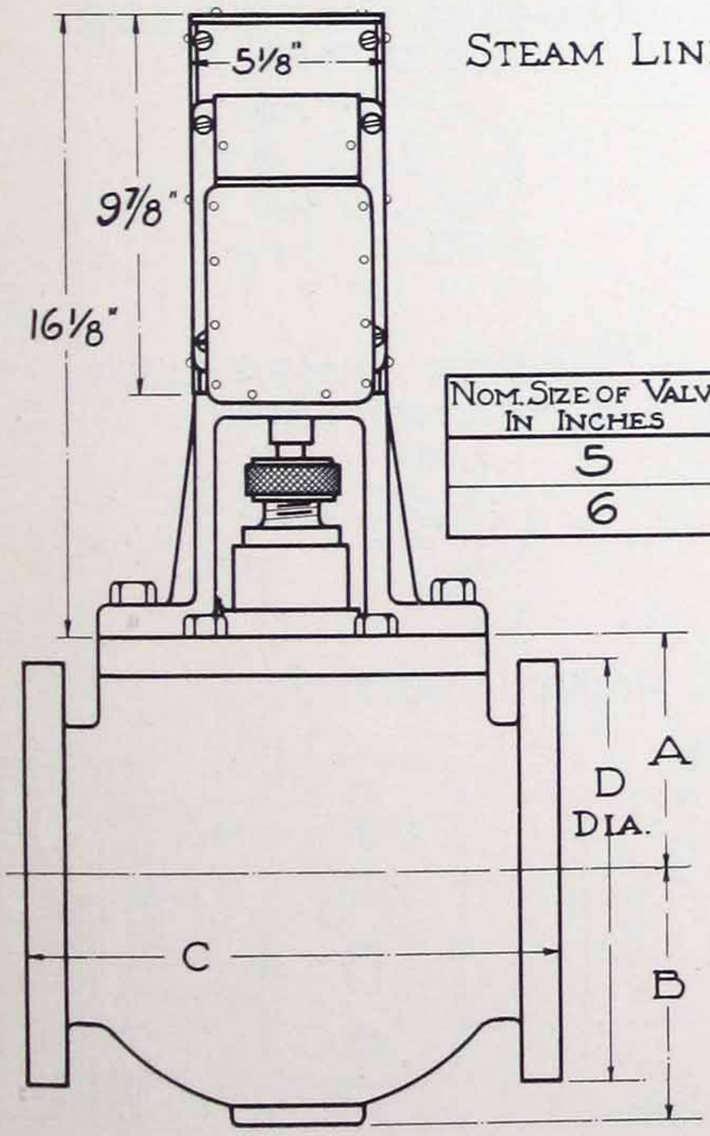




HYGROSTAT



STEAM LINE VALVE



NOM. SIZE OF VALVE IN INCHES	A	B	C	D
5	5 1/4	5 1/2	12 1/8	10
6	6 1/4	6 1/2	13 3/4	11

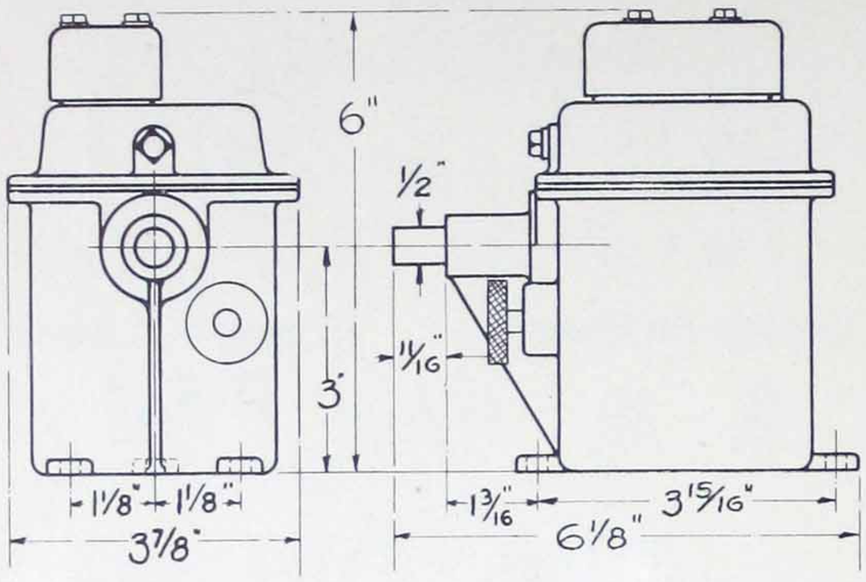
DIMENSIONS OF UNITS

STEAM LINE VALVES

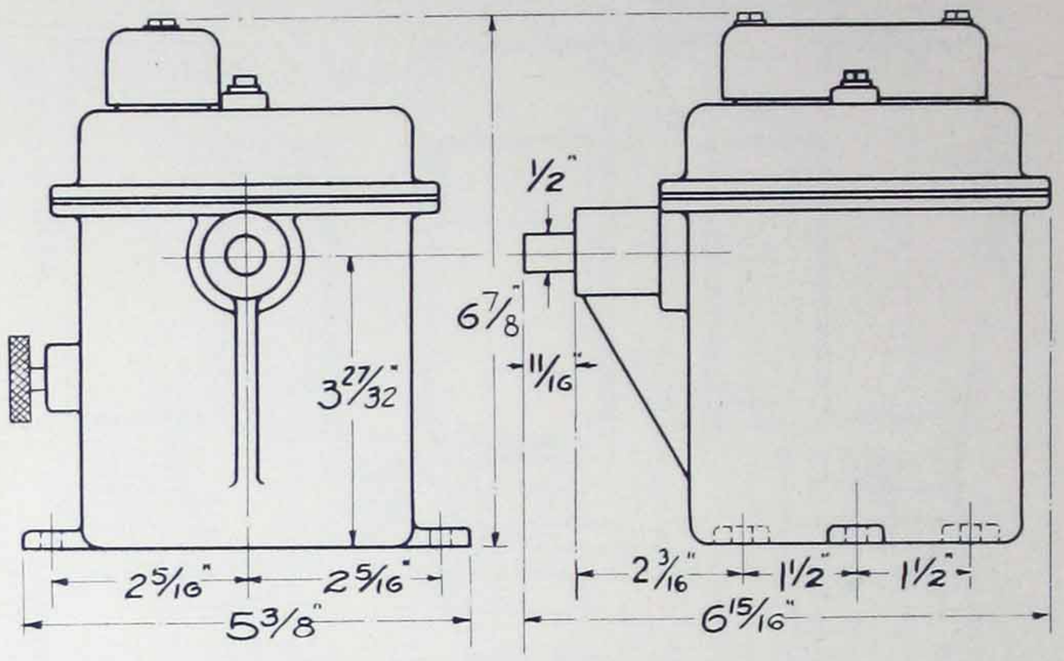
FITTINGS FOR MOUNTING BRASS TUBING

HYGROSTAT

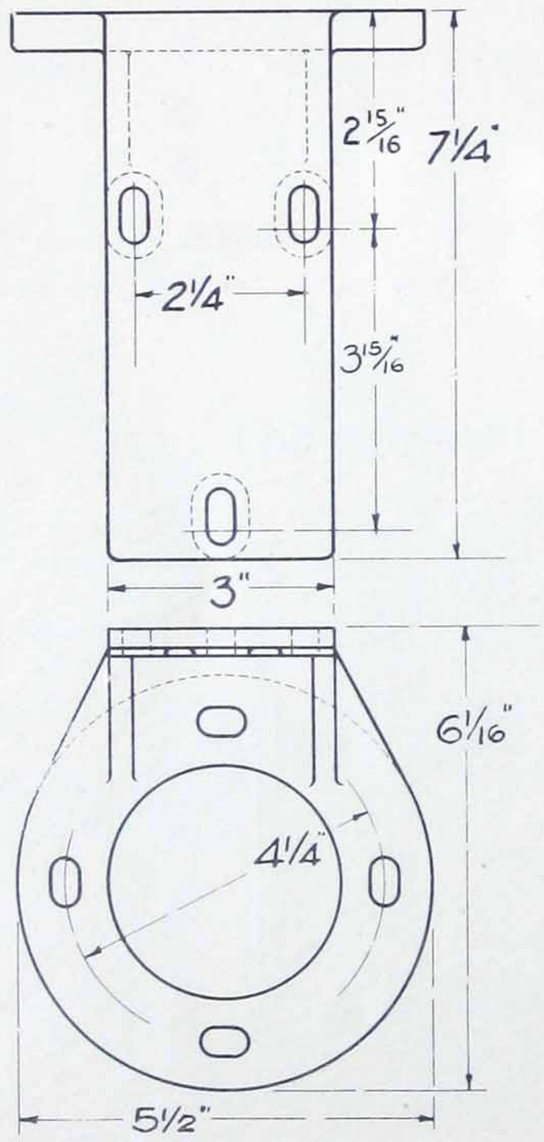
SMALL DAMPER CONTROLLER



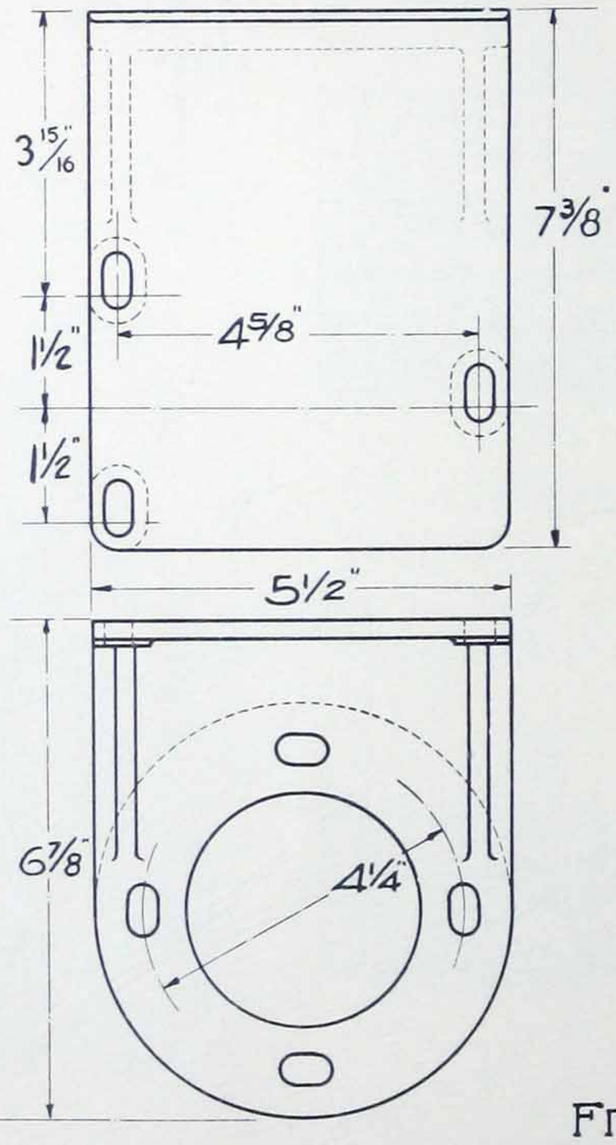
LARGE DAMPER CONTROLLER



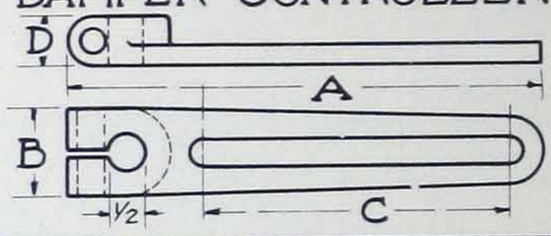
BRACKET FOR SMALL DAMPER CONTROLLER



BRACKET FOR LARGE DAMPER CONTROLLER

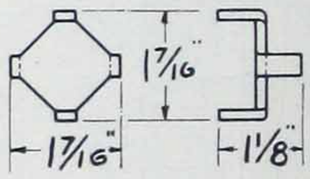


LEVER FOR DAMPER CONTROLLER

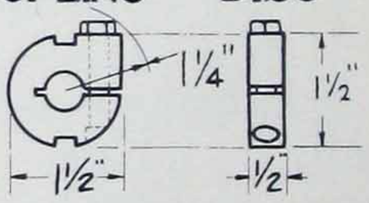


	A	B	C	D
SHORT	3 11/16	1 1/8	1 5/8	5/8
MEDIUM	4 15/32	1 1/8	2 9/32	5/8
LONG	6 3/16	1 1/8	4"	5/8

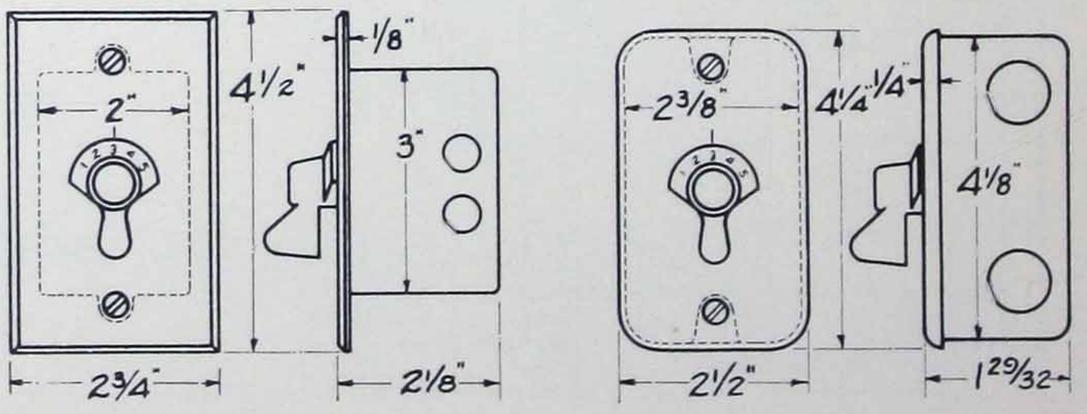
DAMPER CONTROLLER COUPLING



DAMPER CONTROLLER COUPLING DISC



FIVE POINT SWITCHES



DIMENSIONS OF UNITS

DAMPER CONTROLLERS
BRACKETS
LEVERS
COUPLING
FIVE POINT SWITCHES

Digitized by:

INTERNATIONAL

ASSOCIATION FOR
PRESERVATION TECHNOLOGY,
INTERNATIONAL

BUILDING
TECHNOLOGY
HERITAGE
LIBRARY

www.apti.org

From the collection of:

CCA

CANADIAN CENTRE FOR
ARCHITECTURE /
CENTRE CANADIEN D'ARCHITECTURE

www.cca.qc.ca